THE CALIFORNIA IRRIGATED FARM PROBLEM

M. L. REQUA & H. T. CORY

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The contents of this book have been prepared jointly by the undersigned. It is, in considerable part, a compilation from authorities referred to and embodies the results of the authors' investigations extending over a period of several years. The conclusions reached are as follows:

1st. California of all states offers the greatest future possibilities in irrigated farming.

2nd. Increase of population and wealth in California is largely dependent upon irrigation.

3rd. Northern California is equal, if not superior, to Southern California in point of productiveness and variety of corps.

4th. Land selling in Northern California today for $50. to $75. per acre is in every way equal to land in Southern California that is selling for from $200. to $400. per acre.

5th. Northern California has many natural advantages not enjoyed by Southern California and vastly greater irrigable acreage.

6th. The greatest profit without risk is to be obtained by farming the land on a large scale and selling only after development has been completed, in small tracts fully improved, to men of proven ability for a small cash payment with the balance deferred over a long period of years.

M. L. REQUA

H. T. CORY

WASHINGTON, D. C.
MARCH 1, 1919

LETTERS OF C. J. BLANCHARD,

STATISTICIAN, UNITED STATES RECLAMATION SERVICE

and of

DR. E. J. WICKSON,

EMERITUS PROFESSOR OF HORTICULTURE AND

FORMER DEAN OF THE COLLEGE OF AGRICULTURE

UNIVERSITY OF CALIFORNIA

BERKELEY, CALIFORNIA.

Washington, D. C., Jan. 3, 1919.

Mr. H. T. Cory,
Nevada Bank Building,
San Francisco, Cal.

Dear Sir:

I have read carefully the report prepared jointly by you and Mr. Requa. It is the most comprehensive and, in my opinion, the best statement of irrigation in California I have read.

Of especial interest and value are the conclusions reached by you as to the best method of promoting the sale of lands held in large bodies by private companies. I fully concur with you in your recommendation that large tracts be prepared for cultivation, houses erected, civic centers established, and roads laid out in advance to colonization. For some time to come, as I see

it, the greatest demand for homes by the desirable class of settlers will be for lands which are either prepared for cultivation or actually in crop. The vicissitudes of pioneering are now so well understood that the homeseekers are avoiding them. "Let the Company do it" appears to express the general view of the new comers..

So much important and valuable data is contained in your report that it should be made available for wide distribution.

Cordially yours,

(Signed) C. J. BLANCHARD,

Statistician.

Berkeley, Cal., Nov. 30, 1918.

Mr. Mark L. Requa,
San Francisco, Cal.

My dear Sir:

I have read carefully the manuscript volume entitled "Irrigation in California" referring especially to tracts in the Sacramento Valley available for irrigation development and crop production. I am familiar, from personal observation and knowledge of their agricultural history, with the lands described in the volume. The description of the suitability of the lands for the productions contemplated impress me as carefully drawn and the enterprises outlined are, from an agricultural point

of view, clearly practicable. I have also closely considered the estimates of volumes, cost and values of products attainable on these lands by irrigation and am sure they are well within the actual results of experience upon well-farmed lands in the several lines of production which are included.

Perhaps the most surprising feature in the situation is that in view of the high prices of land indicated by sales in the different parts of the coast, there should be such areas of good land purchasable at low price in the very center of California. It is surprising and is explained by the condition of land holding peculiar to California where large tracts, which came into private ownership by grant or pioneer purchases from grantees, have been held with dog-in-the-manger persistence for decades by those who have neither capital nor enterprise for development. These original owners having died or become superannuated and the lands themselves having in many cases become incumbered because slack farming did not afford satisfactory income, their present owners must sell and can sell only to those who can command capital enough to finance the improvements required to put the lands into full production since the lands in their present condition do not favor intensive farming and are incapable of sale in small parcels. This being the case, there arises the large purchasers' opportunity for investment and improvement with the "unearned increment" wholly to be earned thereby. So far as these opportuni-

ties exist, I believe money can now be invested in good California land with water attached, with a better prospect for great and quick returns than ever before in the history of the State.

Very respectfully,

(Signed) E. J. WICKSON.

"THE BACK TO THE LAND PROBLEM:

The President in one of his present-tour speeches, discussed the cityward tendency that is depopulating the agricultural regions in a tone that seemed to imply that education and agitation could turn back the tide. He left out of account the chief obstacle that presents itself to city men of small means or no means who want to get back to the land. Their chief obstacle is the lack of capital.

At the root of the great national problem detailed so impressively by the recently published census figures on agriculture, lies the broad fact of corporate monopoly and that centralization of capital which makes the projecting of all small enterprises increasingly difficult.

The value of bare farm lands, without buildings, was more than doubled during the last decade. It increased by 117.4 per cent. During this period the population of the country increased about 50 per cent faster than the area of cultivated lands. Thus the economic advantage of going into the farming business - for anybody who has the capital to make a start - is the plainest fact of contemporary social life.

This fact is well known. Yet the farming business languishes and shrivels. The reason is not sentimental. For sentiment is all on the side of rural independence in exchange for the servitude of factory and office. The truth is that multitudes of people would cut and run from the cities within a week if they had the money to finance a farm.

Here is the real difficulty. It ought to be faced by publicists, financiers and philanthropists."

(San Francisco Examiner,
October 5th., 1911.)

INDEX OF AUTHORITIES QUOTED:

Because of the extensive quotations and to avoid large use of footnotes, the following numerals heading paragraphs in this report are used to indicate quotations from publications corresponding thereto as follows:

1. "Irrigation in California" by F.W. Roeding, Irrigation Manager, being Bulletin 237 of the Office of Experiment Stations, United States Department of Agriculture, prepared under the direction of Dr. Samuel Fortier, Chief or Irrigation Investigation. Government Print, Washington, May 4, 1911. 61 pp. 1 pl.

2. "Irrigation in the Sacramento Valley, California" by Dr. Samuel Fortier, Chief of Irrigation Investigations, being Bulletin 207 of the Office of Experiment Stations, United States Department of Agriculture. Government Print, Washington, March 15, 1909. 99 pp. 1 pl.

3. "Storage Reservoirs on Stony Creek, California", by Burt Cole, being Water Supply & Irrigation Paper No. 86 of the United States Geological Survey, Department of the Interior. Government Print, Washington, 1903. 63 pp. 15 pls.

4. "Soil Survey of the Woodland Area, California", by Morris, Warner, Westover and Ferguson, being Advance Sheets - Field Operations of the Bureau of Soils, 1909, of the United States Department of Agriculture. Government Print, Washington, January 31, 1911. 57 pp. 2 maps.

5. "Soil Survey of the Colusa Area, California", by Lapham, Sweet, Strahorn and Holmes, being Advance Sheets - Field Operations of the Bureau of Soils, 1907 of the United States Department of Agriculture, Government Print, Washington, January 9, 1909. 50 pp. 2 maps.

6. "California Resources and Possibilities", by the California Development Board. California State Printing Office, Sacramento. Issues for 1911 to 1918 inclusive.

7. "Irrigation Institutions", by Elwood Mead, C. E., Dr. Eng. Macmillan Co., New York, 1903. xi + 392 pp.

In addition, many bulletins and other publications of the U. S. Department of Agriculture in its various branches; the Agricultural College and the Experiment Station, University of California; the reports of California State Boards of Equalization, Agriculture, etc.; publications of the various branches of the U. S. Geological Survey; and numerous other authorities have been freely drawn upon.

Special acknowledgment is made for the assistance rendered by Dr. E. J. Wickson, former Dean of the College of Agriculture, University of California, for many data furnished and valuable suggestions and criticisms. Prof. E. W. Major, formerly of the Experimental Farm, University of California, Davis, California; Mr. Frank A. Adams, in charge of irrigation investigations in the State of California, Office Experiment Station, U. S. Department of Agriculture; and numerous other authorities and experts who have also rendered extremely valuable assistance in many ways. To all these the writers wish to extend their sincere appreciation.

CHAPTER I.

PROBABLE FUTURE POPULATION OF CALIFORNIA.

James J. Hill says in his book "Highways of Progress": "Some irrigated lands in Egypt support 900 persons to the square mile; in Italy over 800 and in India over 1200. It has been estimated that there are 60,000,000 acres of irrigable land in the United States."

In the Sacramento and the San Joaquin Valleys there are 6,000,000 acres, or one-tenth the total irrigable area of the United States, and if a density of population equal to the Italian density is assumed these two valleys would eventually support a rural population of 7,500,000 people. If to this is added the population of the central California cities, it is not difficult to conceive a total of 12,000,000 as the ultimate population of Central California and perhaps twice this for the population of the state as a whole, or approximately nine times the present population.

The density of population in all of Italy is about 300 per square mile. The same density applied to the area of California would mean a population of

47,000,000 but because of the large area of desert it is not likely that California will ever approach this latter figure.

CHAPTER II.

CALIFORNIA - GENERAL STATEMENT.

To appreciate intelligently the future agricultural and horticultural possibilities of California, it is necessary to understand its climatic conditions; its soil, and the markets to be reached.

SIZE, LATITUDE, AND FARMING AREA

Fronting on the Pacific Ocean, California extends from latitude 32°N. to latitude 42°N. or approximately 700 miles north and south, and has an average width of 200 miles east and west. The Coast Range of mountains along the sea coast interposes a barrier between the ocean and the great central valley and the Sierras beyond. These two mountain chains furnish the source of a large part of the water which will be used for the irrigation of the great valley. The accompanying relief map will give a clear idea of the topography of the State and show the dominating position which the great central valley commands in any calculations of future growth of population and husbandry.

California is next to the largest State in the Union and has an area of 158,360 square miles. Of this area one-fifth is calculated as being valley and foothill land susceptible of immediate cultivation. Other areas will be cultivated in time to come as

population increases, but for present purposes one-fifth of the area may be assumed as farming land; or 20,270,000 acres.

AREA PARTICULARLY CONSIDERED

It is not the intention herein to deal with the entire state; the great Coast area of Southern California will be but slightly touched upon; and the area between the Coast Range and the Ocean, while of great potential value, is relatively of quite small importance and will not be considered at all. This discussion deals principally with the area between San Francisco on the south and Red Bluff on the north - the great Sacramento Valley - consisting of 2,166,120 acres, the annual run-off tributary to which, according to J. B. Lippincott (formerly Supervising Engineer of the United States Reclamation Service) is sufficient to cover the area to a depth of 9 feet.

To the south, the San Joaquin Valley, comprising an area of 7,380,000 acres, of which 4,800,000 is irrigable, offers numerous opportunities but it is not been considered with the same detail as is the Sacramento Valley.

SIZE COMPARED WITH OTHER STATES

Assuming the farm area of the State as one-fifth of the total area, or 31,673 square miles, it is equal to the combined areas of the States of Vermont, Massachusetts, New Jersey, Connecticut and Rhode Island,

the total population of which is 7,900,000. Belgium and the Netherlands have a total area of 24,000 square miles and a pre-war total population of nearly 14,000,000. Comparing the total area of the state it equals the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Indiana, the total population of which is 20,900,000. With a population per square mile of 15.2 in 1910, it compares with Rhode Island, 508; Massachusetts, 418; New Jersey, 337; New York, 191; Pennsylvania, 171; Ohio, 117 and Illinois 100.

COMPARISON OF LATITUDE

Roughly speaking, the State occupies the same latitude as the area bounded on the north by Rome, Italy, and on the south by Alexandria, Egypt; its greatest elevation is Mount Whitney, 14,502 feet; its greatest depression Death Valley, 427 feet below the sea level. Between these two extremes almost every conceivable variation of climate is encountered. In the high Sierras snow falls to a depth of 20 to 35 feet on the level, and in Death Valley rain is almost unknown. The climate is so varied that it has been said without exaggeration: *"Excepting strictly tropical products there appears to be nothing which is cultivated elsewhere in the world that will not flourish in some part of California."

*(Statesman Year Book 1909.)

Professor Hilgard says:

"Taken as a whole, California corresponds in its climatic features and adaption to the Mediterranean region of Europe and Africa - a grand Riviera, with a partial background of the desert as well, where the date palm and the ostrich find a congenial home, and alluvial plains equalling in richness the famed delta of the Nile."

DIVERSITY OF PRODUCTS AND CLIMATIC CONDITIONS

(7) "No other state has as diversified products or as highly-priced farming land. The usual limitations imposed by latitude are here set aside. The leading irrigated districts of both northern and southern California have the unique distinction of being able to grow all the products of New England and Florida on the same acre of land. Date palms grow in the latitude of southern Illinois and oak and orange trees shade the same blue grass lawn. The summers are not too hot for the turf nor the winters too cold for the trees. In this favored country there is a wet and dry season. Winter is the season of rain and is the growing season for many of the products of the Temperate Zone. The rainless season comes during the period of harvest and fruitage. Grain ready for the reaper may stand uninjured for months. The curing of forage is attended with none of the uncertainty or risk of loss which attends this work in humid districts. It is hard to

estimate how much a cloudless sky has done towards developing the fruit-growing industries of California. Especially is this true of the dried fruits; Peaches Prunes, Apricots, Nectarines, Raisins and Figs could nowhere else in this country be dried in the sun with the safety and cheapness that attends this work in California." The same authority in a report to the U. S. Agricultural Department makes this remarkable statement regarding the Sacramento Valley:

"Within a radius of five miles in the Sacramento Valley I saw every product of the temperate and semi-tropical zones which I could call to mind. Apples and Oranges grew side by side, as did Oak and Almond Trees. These were Olives from the South and Cherries from the north. A Date Palm seemed equally at home with an Alfalfa meadow; Figs and Tokay Grapes were apparently as much in their element as the fields of wheat and barley or the rows of Indian Corn, some of the stalks of which measured fifteen feet in height. All of these could have been grown on a single acre, and doubtless have been. It is a sinful waste of opportunities to continue using thousands of acres of this land to grow wheat, which steadily impoverishes the soil and robs the pockets of its owners. The irrigable lands of California are no place for bonanza (wheat) farms. They are far better suited to the creation of ten and twenty acre farms."

(7) "The resources of California soil and climate are unexcelled. A profitable crop of potatoes may be followed by a crop of corn the same season. Here on these lands you may grow anything that France, Italy, Florida or New England can produce. Here the farmer may have something to sell every month in the year, while living in a healthful and agreeable climate where work is a pleasure and results sure."

(2) "California has always been considered a state of great possibilities. Her mines and her commerce and her climate and agriculture have long been the theme of inspiring pen-pictures. With a range of climate and soil and of mountain and valley more varied than that possessed by any of her sister states, with a geographical position and commercial facilities naturally favorable to intensive development, she has ranked as the leader in the upbuilding of western America. But while her gold and her seaports and her forests and commerce have made her position unique among the States, her future has always been bound up in her agriculture. Over half a century of development has shown that if the agriculture is to develop even a fraction of what the state is capable it must be founded on irrigation."

(1) "Possibly nothing has attracted so much attention to the state as its unusual and delightful climatic conditions and their general uniformity. The months of June, July, August and September are rainless, practically

without exception, while the rainy seasons extends from October to May, inclusive. The heaviest precipitation occurs between November and March, and the annual amount increases with the latitude and altitude."

"Thunder showers are rare except in the high elevation of the Sierras, where they occur occasionally throughout the summer. Winds of high velocity are very unusual, and such strong winds as do occur are confined as a rule to the spring months, except close to the coast, where trade winds from the ocean blow throughout the spring and summer months. Killing frosts in the lower altitudes are confined almost entirely to the winter months of December, January and February. Occasional heavy frosts have occured in the great agricultural sections in October and April, but an entire failure of crops from this cause is unknown."

CLIMATE A RESOURCE

(6) "The California climate is by most people regarded as an attraction rather than a resource, but it is a resource because by its influence has resulted the marvelous diversity and extraordinary number of agricultural products, and often practically all such products profitably grown on the same body of land. It is a resource, because a man's labor here can be profitably employed every day in the year, because there is no month when vegetation in some form is not growing, and because it furnishes ideal condition for the growth of irrigated

crops. There is no time in California when all Nature is at rest or plant life is sleeping. In the field, orchard, garden, factory, and in the mines, on the stock farm and in the dairy, every day is a day of productive labor. Shipping fresh and deciduous fruits is begun in May and there is no cessation until December. In November shipping of citrus fruits is begun and they overlap the deciduous fruits and thus continue the year through."

GROWTH OF POPULATION

Roughly speaking the population of the United States has doubled in thirty-five years. In the early part of the 19th century the rate was slightly more rapid.

The table herewith shows the population in ten year periods and the increase per annum expressed in percentages.

Table No. 1.

Year	Population	Per cent Increase per annum
1790	3,939,214	-
1800	5,308,483	3.51
1810	7,239,881	3.64
1820	9,638,453	3.31
1830	12,866,020	3.35
1840	17,069,453	3.27
1850	23,191,876	3.59
1860	31,443,321	3.56
1870	38,558,371	2.36
1880	50,155,783	3.01
1890	62,947,714	2.55
1900	75,994,575	2.07
1910	91,972,266	2.10

If we assume an average rate of only two per

cent per annum for the next thirty years, the population in five year periods will be as follows:

Table No. 3.

Year	Population	Per cent Increase per annum
1915	101,546,579	2.0
1920	112,114,192	2.0
1925	123,785,472	2.0
1930	136,661,590	2.0
1935	150,889,699	2.0
1940	166,598,562	2.0

The increase in the population of California and the Pacific Coast States has been much more rapid. California increased 1900-1910, 60 per cent; Oregon 62 per cent; Washington 120 per cent and all three combined 73 per cent.

If we assume the rates as indicated in the table herewith, the population of California by five year periods will be:

Table No. 3.

Per cent Rate of Increase	Year	Population
	1910	3,377,549
33	1915	3,272,140
30	1920	4,253,782
28	1925	5,444,841
26	1930	6,860,500
24	1935	8,507,020
22	1940	10,378,564

Assuming for the Pacific Coast, i,e. California, Oregon, Washington, an average growth at the same rate, the increase in five year periods will be:

Table No. 4.

Per cent Rate of Increase	Year	Population
	1910	4,193,314
33	1915	5,575,645
30	1920	7,248,339
28	1925	9,437,874
26	1930	11,891,721
24	1935	14,735,734
22	1940	17,989,795

The reason for belief in future growth may be summed up as follows:

1. Completion of the Panama Canal.

2. Desire of many people to escape the rigorous eastern winters.

3. Opportunities afforded by irrigated farming.

4. The fact that Northern California has practically all the natural advantages of Southern California and some additional ones as well.

It is inevitable that the tremendous development in Southern California must be duplicated, but on a far larger scale since there is a vastly greater area of good land, as fine or better climate, unlimited water for irrigation, and water transportation on the Sacramento and San Joaquin rivers, in the one case to Red Bluff 334 miles from San Francisco, and in the other to Fresno 207 miles from San Francisco. To utilize to best advantage these water ways a great deal of money has been and is being spent in improving navigation. The railways recognizing the situation may make rates so low that river traffic will not be profitable. In either case

the benefits from water transportation will be secured.

GROWTH OF POPULATION COMPARED TO AGRICULTURAL GROWTH

Such increases in population - general and local - demand additional sources of food supplies over those now existing. It is a striking fact that the number of cattle in the United States has decreased more than 5,600,000 in 1910, as compared with 1900, while population increased 21 per cent and farming area only 4.8 per cent.

With population increasing much faster than the farming area is being developed, further rise in the price of farm products is inevitable. Further advances in the cost of living must be expected with growing unrest and discontent. There is today nothing more important, nothing more worthy of serious thought and vigorous action by men of large means, than anticipating the situation and creating conditions whereby thousands of families may find homes and thousands of mouths may be fed.

The growth and wealth of the nation is founded on its harvests; its very life is dependent upon the crops of its fields, and yet the late Professor Shaler, of Harvard, has this to say of our trusteeship:

> "Of all the sinful wasters of man's inheritance on the earth - and all are in this regard sinners - the very worst are the people of America."

Little or nothing has been done in the past to

conserve the soil or reap the greatest reward from its tillage. We are confronted with the pitiful spectacle of a wheat yield approximating 14 bushels per acre as compared with 32 in England and 28 in Germany.

Our frontiers have vanished, and there are no longer new fields to be pioneered except in the Southeastern States. We are rapidly approaching the time when the highest type of intensive and scientific cultivation must replace the wasteful methods of the past in order not only that the farmer may secure satisfactory remuneration for his labor but also that we may be able to find food for the added millions of our population in the years to come.

The same ability that has successfully guided the great corporations must aid in solving the problem; the same financial institutions that have poured money into other channels of commercial effort must in the final analysis supply the capital that will make possible the proper development of the farm. Not the farm as we know it today, but the large business enterprise farming thousands of acres in the most efficient and scientific manner, with accurate cost data, and a distributing system adequate to care properly for the products produced. From a purely investment basis there can be nothing more attractive. If the highest types of soil plus irrigation and good management cannot pay a satisfactory return upon the investment, nothing can.

COMPARISON, NORTHERN AND SOUTHERN CALIFORNIA

All the products grown in Southern California may be equally well grown in the Sacramento and San Joaquin valleys. If there are any advantages of soil and climate, they rest with the great valley. The case has been tersely summed up in these words:

(2) "The difference between Northern and Southern California is Irrigation."

California has always been handicapped because of its remoteness from centers of population. Cost of passage from Europe is more than double as much as to New York, with the result that, comparatively speaking, California has received but few immigrants. Labor is scarce, and wages abnormally high. In point of fact, Southern California's astounding accretion of population has so far come almost exclusively from the United States, every section apparently furnishing its pro rata. The influx has been American citizens of the better class who had been planning for years to come to California to live.

RELATIVE GROWTH OF NORTHERN AND SOUTHERN CALIFORNIA

A careful examination of detailed population figures for the entire state clearly show that the excessive population increase is not really of California, as a whole, but of Southern California - Ventura, Los Angeles, San Bernardino, Orange, Riverside, San Diego

and Imperial Counties.

The increase of population from 1900 to 1910 of Southern California was 154 per cent; of the balance of the State only 38 per cent. The development of a territory, of course, cannot be measured exclusively by the growth in population, for there are several other important factors. Chief of these is assessed valuation, building permits, bank clearings, and postal receipts of the important cities; and while there are other minor elements these may be safely taken as typical and characteristic of what is generally known as regional development. These figures show that, unless something in the nature of a widespread calamity or long continued war occurs to change the respective rates of growth, in six years, or by 1935, Southern California will comprise one-half of the State in all essential respects except superficial area.

This condition of affairs exists in spite of the fact that the agricultural and horticultural possibilities of Southern California are quite overshadowed by those of the remainder of the State and particularly the Central Valley, consisting of the Sacramento and San Joaquin valleys. The total irrigated area in Southern California is somewhat more than 300,000 acres, exclusive of Imperial Valley (which will ultimately contain approximately 600,000 acres in the United States and 250,000 acres in Mexico); or a total south of

Tehachapi of 1,150,000 acres, including land in Mexico. On the other hand, the area which will sooner or later be brought under intensive cultivation in the Sacramento Valley alone is in excess of 2,500,000 acres. Consequently, the agricultural lands of all Southern California, including Imperial Valley in California and Mexico, is less than one-half of the irrigable area of the Sacramento Valley alone; or, omitting Imperial Valley, the ratio is 1 to 8. The soil of the southern counties is, to say the least, no more fertile; the water supply is by comparison pitifully deficient; the climatic conditions, even with respect to citrus fruits, inferior, and particularly with respect to the, at least six weeks, later date of ripening and marketing of oranges.

Land prices based on essentially equal fertility, net return, etc., are from two to four times as high in Southern California as in the remainder of the State.

This relative cheapness of northern land was the thing depended upon by many people as insuring immediate diversion of the incoming tide of people from Southern California into the Central Valley.

RECENT IRRIGATION DEVELOPMENT IN SACRAMENTO VALLEY

Based upon there relative values, many companies within the last few years have attempted to develope immense areas of land in the San Joaquin and Sacramento Valleys, and to sell the land in small tracts

to home seekers. Six companies alone bought outright, planned, and more or less completed, throughly satisfactory irrigation and flood protection systems for 482,000 acres. That is to say, six companies alone planned to own outright, and do the necessary engineering work in a thoroughly satisfactory fashion to make available for intensive cultivation, an area 60 per cent greater than the entire irrigated area of Southern California exclusive of Imperial Valley. In addition to these corporations there are hundreds of smaller projects under way, ranging from a few hundred to several thousand acres of land. In most cases the irrigation and protective works are being constructed in a thorough manner. Speaking roughly, at least 900,000 acres of land can be safely, thoroughly, efficiently, and intensively cultivated when all of the large and small development projects in the Central Valley now ready or well under way are completed. This is an area at least three times that of the territory which has as yet contributed any important part to Southern California's development.

MARKETING AND HANDLING IRRIGABLE PROPERTY

It is obvious that a very considerable number of years must elapse before all of this land can be marketed. Herein is the weak link in the chain. It has been assumed that this land would be taken with the same rapidity as land in Southern California. This is

not possible - Northern California is trying to do on barren land what Southern California is doing on highly improved land. Until groves of oranges, lemons, olives and kindred products are actually in bearing; until the transportation facilities have been brought up to a high standard; until the man-created attractions can be made equally as great, Northern California can not hope to secure any large percentage of the class of people now flocking to Southern California. The eastern man with sufficient money to live upon will not pioneer, - he does not have to. The sooner this fact is recognized, the nearer will be the solution of the situation. Relatively, every few people are coming to California who have extremely small means and are seeking homes where they may with a small amount of capital and by enduring privations and hardships achieve within a decade a modest homestead. On the contrary, the majority come on a vacation, become interested, and plan sooner or later to make their homes in the Golden State. When they return for that purpose it is not with the slightest idea of pioneering but rather with the intention of living in greater comfort than in their old homes.

FACTORS ATTRACTING HOMESEEKERS

Such people are not only attracted by the climate but by the presence of old friends, by the type of civilization to which they have been accustomed, by newer and more attractive social institutions, transpor-

tation facilities, convenience and modernity of architecture, inexpensive residence districts in cities, and modern community facilities - not by the possibility that an Eden may be created but by an earthly paradise that already exists.

If such a class of population is to be secured the stage must be set for them, with producing groves, good roads, and a finished development, rather than undeveloped areas and future possibilities painted in rosy colors by the land agent. Northern California land companies hoped to accomplish in five years or ten years the results attained in Southern California in thirty years; and, worst of all to attain this through the efforts of small farmers with scarcely enough money to make the initial payment on 20 acres of land and build a cheap habitation, hoping for the rest to come from the soil. This simply can not be done. Particularly is this true because of the tremendous area capable of intensive cultivation.

The development of Southern California can most emphatically be reproduced in the Sacramento Valley, but it cannot be accomplished without the investment of the proper amount of money, under common sense supervision, to make the region so attractive as to compete with Southern California.

PROBABLE INFLUENCE OF THE PANAMA CANAL

Experience has been universal that of the

original home seeker settling on irrigated projects during the past twenty years relatively few succeed. Such unsatisfactory results are partly because new comers do not understand the soil, climatic conditions, or irrigation; and more largely to the fact that they have entirely insufficient capital. Making a home on an irrigated project is not a poor man's task. Consequently, it is fatuitous to expect that a large number of purchasers of Central California farms ready for intensive cultivation will be brought in from Europe through the Panama Canal after the world war; such people will have neither the experience or knowledge of California agriculture and horticulture nor the capital necessary to make good. There will be eventually a large influx through the canal, no doubt; not of capitalists, however, but of farm and domestic laborers, with insufficient money to farm irrigated land - probably with far less than $500 total cash capital on the average.

An irrigated farm is distinctly not a poor man's operation. Properly developed and in bearing, the total cost including land, water, and improvements, would be not far from $500 per acre and up. A 20-acre farm would cost $10,000, and the average European who has $10,000, would hardly come to California, certainly not in large numbers.

OPPORTUNITIES IN SACRAMENTO VALLEY

California is the only State in the Union wherein the identical varieties of Grapes which yield the world's commercial products of Raisins and Wines are cultivated, and people from Southern France, Spain, Italy and Northern Africa will find climatic conditions identical with their present homes. The date Palm of Africa is being grown on a commercial scale in the Coachella and Imperial Valley; and Cotton, Oranges, Lemons, Figs, Olives and Wine Grapes in widely separated localities.

CONCLUSIONS

Summed up in a few words the following conclusions seem clearly indicated:

1st: It is possible to secure in more or less compact bodies large tracts of land that are susceptible of irrigation at prices ranging from $40 to $100 per acre.

nd: Water in superabundance is available for irrigating the land, and at a very reasonable cost per acre; providing, and only providing, it is done on a large scale. This, as will be pointed out later, is the real crux of the situation and the reason for the great opportunity which exists.

3rd: Land so developed is worth from $150 to $300 per acre based upon net return.

4th: Under proper care and cultivation this land will return a net profit of 10 per cent on from $200 to $1000 per acre, depending upon the crop planted and the period elapsing after planting.

5th: The old method of buying large ranches and sub-dividing them is becoming less and less satisfactory year by year. It requires something more than the surveyor's chain and a wagon load of stakes plus an advertising campaign to increase the intrinsic value of land.

6th: To assure absolute and unquestioned success it is necessary to:

(a) Own the land.

(b) Own the water.

(c) Properly prepare the land for irrigation.

(d) Cultivate and farm it in large units in order to pay interest on the investment or until it is sold in small tracts on long time payments to the farmer or settler seeking a home and a livelyhood.

CHAPTER III.

CALIFORNIA - MARKETS AND PRODUCTION.

The markets for California products may be divided into four classes:

1. Local Consumption.
2. Eastern shipments by rail to points from Nevada to New England.
3. European shipments.
4. Oriental shipments.

LOCAL CONSUMPTION

San Francisco and the territory surrounding it within a radius of 50 miles contains a population approximating 850,000.

Table No. 5.

	1910	1900
San Francisco	416,000.	343,000.
Oakland	150,000.	66,000.
Berkeley	40,000.	13,000.
Alameda	23,000.	16,000.
San Jose	28,000.	21,000.
Richmond	7,000.	nothing
San Rafael	6,000.	3,800.
	670,000.	462,800.

These cities all front on San Francisco Bay and, with the exception of San Jose, which is 50 miles from San Francisco, might be considered as one community. The greatest distance from San Francisco to any of them is not in excess of 15 miles. The total population of

the bay counties was as follows:

Table No. 6.

	1910	1900
Alameda	336,000.	130,000.
Contra Costa	31,000.	18,000.
Marin	25,000.	15,000.
San Francisco	416,000.	343,000.
San Mateo	25,000.	12,000.
Santa Clara	83,000.	60,000.
	836,000.	585,000.

The State as a whole increased from 1,485,000 to 2,377,000 or 60 per cent. The Sacramento and San Joaquin Valleys are the natural source of the future great supply of produce that will be required to feed the cities clustering around San Francisco bay. Transportation by river steamers and barges is a fixed industry, extending at present as far north as Colusa, on the Sacramento, and south on the San Joaquin to Stockton. A glance at the relief map of the State will show the relation of San Francisco to this area and its corresponding advantages from the standpoint of transportation.

While it is true that the Bay counties themselves do raise large quantities of produce they can not compete with the great central valleys owing in large measure to the lack of water for irrigation.

Shipments of certain California products find their way to every state in the west as well as to more remote localities. In raisins, olives, olive oil, and

dates California is without a competitor. In oranges, lemons and grape fruit Florida, and to a slight extent Arizona, are the only competing states. Forty per cent of all commercial oranges of the world are produced in California.

It is not possible from figures at hand to segregate shipments to eastern and foreign localities, but the annexed tables will afford an idea of total shipments over a considerable period of years and clearly show the steady growth of the industry.

DRIED FRUITS

Nearly all kinds of deciduous fruits are dried for the market, but prunes, peaches and apricots are the most important. The dried output of all, except figs, varies largely according to the season, the demand of the Eastern market for fresh fruit, and the prices offered by the canners. *

Table No. 7

OUTPUT OF DRIED FRUITS NOT INCLUDING PRUNES AND RAISINS 1900 - 1916, IN TONS

Year	Peaches	Apricots	Apples	Pears	Plums	Nectarines	Figs	Total Tons
1900	17,170	14,000	3,150	7,275	1,950	435	2,000	46,220
1901	14,725	7,776	3,225	3,290	1,725	317	3,260	34,498
1902	25,210	18,762	4,875	2,625	1,280	455	3,625	57,020
1903	16,075	10,500	1,800	2,325	1,435	317	3,000	35,657
1904	11,500	8,500	1,500	1,750	1,150	210	2,850	27,630
1905	17,500	13,250	3,250	1,750	930	185	3,625	46,683
1906	11,250	3,250	2,750	3,500	1,100	170	3,375	25,595
1907	12,000	1,500	1,500	500	750	137	3,000	19,575
1908	22,500	19,000	3,000	1,200	1,000	350	3,000	51,550
1909	20,000	14,500	2,500	1,250	500	375	3,500	42,950
1910	25,000	16,000	3,100	1,000	375	250	3,775	49,850
1911	14,000	11,000	3,500	-	-	-	5,300	34,000
1912	30,000	20,000	3,600	(includes Plums and			5,000	58,600
1913	23,000	10,500	1,900	nectarines)			5,000	40,400
1914	31,000	20,500	4,500				6,500	68,500
1915	32,000	19,500	4,000				8,600	64,100
1916	28,000	10,900	4,500				6,700	50,100
Average seventeen years	20,996	13,260	3,097				4,250	

* Most of the statistical information in this chapter has been taken from the reports of the California Development Board given as No. 6 in the list of authorities quoted Page --- 7.

Table No. 8.

GENERAL SUMMARY AND COMPARATIVE TABLE OF SHIPMENTS OUT OF STATES
BY RAIL OF FRUITS, WINE, BRANDY AND VEGETABLES FOR TWENTY-TWO CONSECUTIVE YEARS.
(tons of 2,000 pounds)

Kinds:	1895	1896	1897	1898	1899	1900	1901	1902	1903
Green Deciduous fruits	66,254	57,638	72,350	69,732	96,943	91,176	96,673	100,390	101,198
Citrus Fruits	115,825	99,156	98,547	180,658	131,916	226,546	323,871	225,668	299,623
Dried Fruits	61,366	48,522	75,159	76,662	86,925	90,052	106,987	151,944	149,531
Raisins	46,390	34,434	39,065	47,796	36,008	36,047	43,314	47,575	39,963
Nuts and Olives	3,234	4,972	5,808	5,815	6,608	6,518	8,462	10,918	9,377
Canned Fruits and Vegetables	41,395	45,546	73,464	52,219	75,240	75,556	83,229	80,634	94,204
Raw vegetables	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wine and Brandy	.....	.....	.....	.....	.....	.....	.....	.....	.....
T O T A L S	334,487	290,271	364,396	432,885	433,642	525,898	659,537	617,133	693,898
Total cars of 10 tons of Fruit Vegetables, Wine and Brandy	45,257	38,254	48,072	56,149	55,482	66,797	83,731	77,538	88,084

Kinds:	1904	1905	1906	1907	1908	1909	1910	1911	1912
Green Deciduous fruits	73,983	115,083	113,679	106,066	161,224	203,275	204,876	187,884	167,603
Citrus Fruits	385,747	454,083	383,418	413,696	399,094	475,959	446,384	580,799	479,099
Dried Fruits	156,769	118,479	112,176	184,821	133,846	154,756	128,892	114,483	194.175
Raisins	54,134	32,634	42,457	x	x29,601	61,584	67,278	# 46,513	-------
Nuts and Olives	9,810	7,610	5,131	7,198	10,887	12,438	12,308	12,751	15,399
Canned Fruits and Vegetables	86,077	91,877	77,626	104,624	ø85,135 93,500	ø71,223 86,014	ø73,746 78,829	ø83,258 130,738	89,946 129,660
Raw vegetables	.....	.....	.....	.....	70,758	75,656	82,144	83,952	93,250
Wine and Brandy	.....	.....	.....	.....					
T O T A L S	766,523	819,769	734,490	816,406	984,046	1,140,905	1,094,457	1,240,378	1,169,132
Total cars of 10 tons of fruit vegetables, wine and brandy	92,052	99,409	90,577	95,299	98,603	120,690	109,456	116,267	116,913

\# Only parts; balance included as dried fruits
x All shipments of raisins by rail and by sea are included in dried fruits in 1907 and somo in '08
ø Includes shipments of canned vegetables
\+ Including Western Pacific which made no returns previous years

Table No. 8, (Continued)

	1913 +	1914 +	1915 +	1916 +
Green Deciduous Fruits	186,393	232,806	264,155	311,471
Citrus Fruits	238,222	561,136	561,087	539,328
Dried Fruits	111,783	93,014	109,730	174,988
Raisins	39,279	47,688	71,023	80,083*
Nuts and Olives	11,611	9,622	18,766	22,040
Canned Fruits	106,998	65,245	115,178	362,895
Vegetables	147,277	247,512	331,941	351,295
Raw Vegetables	83,012	53,085	52,276	148,550
Wine and Brandy	.....	.....	.....	.....
Total cars of 10 tons of fruit vegetables, wine and brandy	92,457	129,010	158,415	201,122

* Exclusive of the Santa Fe Railway as it included raisins in reporting dried fruit shipments and kept no seperate record.

PRUNES Of dried fruits, prunes come next in importance to raisins. Prunes are grown in many counties throughout the state; the largest center of this industry is the Santa Clara Valley. A good many prunes are grown in the San Joaquin and Sacramento Valleys and also in Contra Costa and Sonoma Counties.

The output varies largely in different years.

Table No. 9.

CALIFORNIA PRUNE OUTPUT.

Year:	Tons:	Year:	Tons:
1897	48,840	1907	40,000
1898	45,210	1908	25,000
1899	56,863	1909	77,500
1900	87,000	1910	45,000
1901	40,800	1911	95,000
1902	98,500	1912	102,500
1903	82,500	1913	48,000
1904	67,500	1914	56,000
1905	37,500	1915	92,500
1906	90,000	1916	68,500

The canning industry exhibits the following for three years:

Table No. 10

CANNED FRUITS --- CASES

	1916		1915		1914	
	No. 2½, 3 and smaller (all grades)	Gallons (all grades) number of dozens	No. 2½, 3 and smaller (all grades)	Gallons (all grades) number of dozens	No. 2½, 3 and smaller (all grades)	Gallons (all grades) number of dozens
Apples	15,820	98,852½	3,050	39,285	9,185	84,225
Apricots	937,800	194,985	703,550	138,820	949,475	192,880
Blackberries	35,845	63,292½	41,595	64,170	24,080	59,790
Cherries	140,560	14,112½	155,660	13,535	97,295	8,930
Grapes	80,965	10,082½	66,480	5,565	43,210	6,475
Loganberries	26,865	15,282½	11,913	13,323	10,900	5,000
Pears	930,550	51,130	749,200	39,215	749,425	56,315
Peaches, free	838,150	182,395	502,875	164,500	684,050	204,075
Peaches, cling	2,105,550	245,920	1,891,100	258,275	2,325,275	296,380
Plums	61,005	11,872½	66,585	14,315	89,400	21,040
Raspberries	9,325	4,557½	3,430	815	3,890	580
Strawberries	11,025	1,507½	4,997	2,820	16,140	1,995
Other fruits	20,340	10,097½	7,475	6,980	17,305	11,560
TOTAL FRUITS	5,213,800	904,087½	4,207,930	761,618	5,019,630	949,245

Table No. 11

PRODUCTION DURING LAST SIXTEEN YEARS

YEAR	CASES	YEAR	CASES
1901	2,837,982	1909	3,561,173
1902	2,410,407	1910	4,774,156
1903	2,928,515	1911	4,835,404
1904	3,010,210	1912	5,463,730
1905	3,450,037	1913	4,852,090
1906	3,612,660	1914	6,918,120
1907	3,480,469	1915	5,731,166
1908	5,242,078	1916	7,021,975

THE VINEYARD

California is easily the most important factor in viticulture in the United States, and grape culture is one of the most widespread industries in the State; 356,009 acres, according to the State Board of Equalization, being devoted to the industry in the spring of 1916; of which 162,939 acres are in wine grapes; 137,130 acres in raisin grapes, and 55,940 acres in table grapes.

All varieties of European grapes are included, besides many California developments therefrom.

The annual return to the grower of the grape product, including table grapes, dried grapes and raisins, and wine and brandy, aggregates over $20,000,000. The shipments of table grapes out of the State by rail for 1916 amounted to 9,906 carloads.

RAISINS

The center of the raisin industry is in Fresno County, although raisins are produced in other parts of the State. The crop varies from year to year as the appended table shows; that for 1915 and 1916 far exceeds the average of the six preceding years:

(Table No. 12.)

CALIFORNIA RAISIN CROP

Year	Tons	Year	Tons
1897	46,852	1907	30,000
1898	40,383	1908	30,000
1899	35,784	1909	70,000
1900	47,167	1910	53,000
1901	37,125	1911	67,500
1902	54,375	1912	35,000
1903	60,000	1913	65,000
1904	37,500	1914	90,000
1905	43,750	1915	184,000
1906	47,500	1916	138,500

EIGHT COUNTIES WHERE CALIFORNIA RAISINS ARE PRODUCED

(Table No. 13.)

County	Acres in 1916.
Fresno,	15,320.
Tulare,	15,320.
Kings,	13,450.
Colusa,	3,000.
Sutter,	2,905.
San Diego,	2,630.
Madera,	2,388.
Yolo,	1,300.

SEEDED RAISINS

Fresno County is the center of the seeded raisin industry, where it originated. The following figures show the wonderful increase in this popular form of raisin during the last fourteen years:

(Table No. 14.)

Year	Tons.	Year	Tons.
1896	700	1906	24,000
1897	3,500	1907	26,000
1898	7,000	1908	24,000
1899	12,000	1909	28,000
1900	14,000	1910	31,500
1901	14,000	1911	33,000
1902	16,000	1912	35,500
1903	18,000	1913	35,000
1904	18,000	1914	40,000
1905	21,000	1915	45,000
		1916	45,000

(The above figures are only approximate.)

The production in 1911 of sweet wine was the greatest in the history of the industry by over 4,000,000 gallons. The output of dry wine was well above the normal from 1907 to 1913. The champagne production in 1916 was about 1,000,000 bottles.

The following table shows the product of wine and brandy for the last twenty years.

(Table No. 15.)

	Dry Wines Gals.	Sweet Wines Gals.	Brandy Gals.
1897	28,736,400	5,197,300	1,442,468
1898	10,750,000	7,779,000	1,350,000
1899	15,103,000	8,330,000	1,699,035
1900	16,737,260	6,940,300	3,256,513
1901	16,473,731	6,270,300	1,688,482
1902	28,324,146	14,835,143	4,584,173
1903	21,900,500	12,670,356	1,972,000
1904	15,589,342	13,571,856	4,430,839
1905	20,000,000	10,700,000	1,250,000
1906	26,000,000	15,000,000	1,345,000
1907	27,300,300	15,500,000	1,500,000
1908	22,300,000	14,750,000	1,750,000
1909	27,000,000	18,000,000	2,000,000
1910	27,500,000	18,000,000	2,500,000
1911	26,000,000	23,280,044	2,000,000
1912	22,500,000	17,797,781	1,799,539
1913	25,000,000	17,307,600	1,695,406
1914	22,000,000	16,630,212	3,320,744
1915	21,371,000	4,035,240	2,315,286
1916	23,000,000	19,263,475	3,027,892

(After 1904 brandy used in fortifying sweet wines not included.)

California wines have a wide and growing market. The railroad shipments go mainly to eastern points, while those by sea go to the four quarters of the world.

FRESH AND CANNED VEGETABLES

Fresh vegetable production of the state in 1916 amounted to a large total. The vegetables grown in the central and northern parts of the state, with the exception of asparagus, are mainly consumed in the

home market, and shipments out of the state in 1916 were largely from the southern portion.

(Table No. 16.)

Kinds.	Value
Beans	$19,144,000
Chili Pepper	875,000
Celery	1,000,000
Potatoes	16,000,000
Onions	2,400,000
Rice	3,000,000
	$43,419,000
Melons and Cantaloupes	1,000,000
T o t a l	$43,419,000

The total shipment of fresh vegetables to Eastern markets was about 351,265 tons.

Table No. 17

CANNED VEGETABLES - CASES

VEGETABLES:	1916		1915		1914	
	No. 2½, 3 and smaller (all grades)	Gallons (all grades) number of dozens	No. 2½, 3 and smaller (all grades)	Gallons (all grades) number of dozens	No. 2½, 3 and smaller (all grades)	Gallons (all grades) number of dozens
Asparagus	975,700	7,520	790,900	9,480	762,035	6,775
Beans, String	95,150	14,117½	65,590	16,315	67,860	9,205
Peas	195,410	15,855	167,935	20,732	149,320	12,775
Tomatoes	2,067,800	289,750	1,021,325	161,380	1,680,950	212,700
Other vegetables	152,725	41,900	93,400	26,125	103,855	22,780
Total vegetables	3,486,785	369,142½	2,139,150	234,032	2,764,020	264,235

OLIVES AND NUTS, OLIVE OIL, ETC.

Olive culture is one of the oldest fruit industries in the State. The first orchard was planted in San Diego in 1769, and that county is a large producer of olives and olive oil. There are large orchards in other counties, and every year adds to the number of trees. There are thirty-eight counties reporting over 1,000 trees each, ranging from Shasta on the North to the Mexican line on the south. The number of trees, as reported by the State Board of Equalization, is about 834,939 in bearing. Riverside leads with 108,480 bearing trees. At one hundred trees per acre, the total would equal 8,350 acres.

The two largest olive groves in the State under one management are the Sylmar, near Los Angeles, of 1300 acres, and one near Porterville of 2000 acres.

Statistics of this industry are difficult to obtain. Until recent years it has not been very attractive from a remunerative point of view, but the removal of competition with adulterated oil by the Pure Food Regulations have given it a great impetus. The estimated production for 1916 was 1,000,000 gallons of olive oil and 1,800,000 gallons of pickled olives. The consumption of pickled ripe olives is increasing rapidly, and it is but a matter of time until ripe olives become a staple food product. According to Prof. Jaffa, of the University of California, ripe olives are an ideal food,

containing enormous food values in small bulk, and being extremely palatable; in these respects being far superior to the green olives; the one being a food of highest quality, to be eaten by the handful, the other a pickle to be nibbled.

During the year 1914-15 it appeared on the market in a form known as the dehydrated olive. In 1916 still another form appeared under the name of the Greek Olive, which is a ripe olive cured by a salt process similar to that used in Greece. Owing to the importation of this article being entirely cut off by the European war there is a ready market among the Greek and Turkish residents of the United States, by whom it is largely consumed.

The largest ripe olive packing plants in the world are located in Butte County, California. A process which enables ripe, pickled olives to be shipped without liquid of any kind, thus saving freight charges and making them easier to handle, has recently been evolved by the University of California.

ALMONDS AND WALNUTS

The production of almonds and walnuts by years is shown in the following tables:

(Table No. 18)

Year	Almonds Tons (2000 lbs.)	Walnuts
1895	825	2310
1896	1605	4115
1897	2375	3985
1898	450	5650

(Table No. 18 cont'd)

Year	Almonds	Walnuts
1899	3320	5530
1900	2740	5430
1901	1560	6910
1902	3370	8520
1903	3200	5500
1904	800	7590
1905	2125	5750
1906	900	6125
1907	750	8250
1908	2000	8000
1909	1650	7500
1910	2750	8500
1911	1700	12000
1912	3000	9250
1913	1100	11350
1914	2250	8900
1915	3500	14825
1916	3400	12800

At an average value of $300 per ton, the aggregate of these crops is $4,860,000 for 1916.

SCIENTIFIC DAIRYING

Scientific dairying has largely superseded the old methods in California, as the following table, showing the number of pounds of butter produced in the State by the creamery method and the old method for seven years ending October 1, 1902, demonstrates:

(Table No. 19.)

Year	Creamery Method	Old Method	Totals
1896	10,097,323	21,508,117	31,605,440
1897	10,866,646	17,811,793	28,678,439
1898	10,410,479	13,280,549	23,691,028
1899	12,725,814	12,143,270	24,869,084
1900	16,486,695	12,296,164	28,782,849
1901	19,017,513	10,713,370	29,730,882
1902	21,593,021	9,935,741	31,528,763

Since 1902 the growth is indicated in the following exhibit:

(Table No. 30.)

Year	Pounds
1903	34,676,311
1904	35,636,909
1905	41,961,047
1906	44,044,578
1907	44,599,211
1908	48,469,585
1909	49,595,869
1910	45,989,140
1911	50,380,736
1912	54,940,886
1913	55,54[illegible],709
1914	59,286,460
1915	67,549,409
1916	70,030,174

California is now well to the front as a dairy state. The increase is mostly in counties where irrigation is practiced.

(Table No. 21.)

IRRIGATION AND DAIRYING

As showing the effect of irrigation on the dairy interests the following exhibit from the reports of the State Dairy Bureau, giving the product of butter in pounds by principal counties, is instructive:

Counties:	1905	1906	1910	1911	1915	1916
Fresno	1,619,746	2,446,897	3,290,825	3,803,644	3,158,220	4,204,416
Kings	1,099,400	1,677,272	3,218,036	3,552,542	3,811,477	3,960,949
Merced	1,563,771	2,361,528	2,510,269	3,102,222	4,253,000	4,028,062
Sacramento	1,508,293	1,617,633	1,102,012	1,405,054	1,737,511	1,422,051
San Joaquin	1,015,568	1,641,374	1,425,543	941,430	1,184,658	1,618,455
Stanislaus	1,564,749	2,759,582	4,363,296	5,166,515	9,973,320	9,980,021
Tulare	1,497,762	2,075,729	3,072,198	3,955,583	4,787,690	4,677,839
Yolo	831,185	1,387,210	1,103,114	1,096,718	1,091,496	1,241,083
Totals	10,700,474	16,165,225	20,085,293	23,023,708	29,997,372	31,132,876
Humboldt (non irrg.)	4,289,739	4,235,927	4,790,280	5,238,382	5,591,870	5,588,604
Imperial (absolutely dependent on irrigation)			1,948,710	2,885,941	6,334,316	6,780,552

For years Humboldt County was considered the home of the Dairying Industry: because of the fogs and mists and excessive rains that drift in from the Pacific Ocean irrigation is there unnecessary. Since irrigation has been adopted in the valley counties they have rapidly come to the front as the above table shows and it is only a matter of a short time ere numerous counties exceed Humboldt in dairy products. Notwithstanding this great increase California is today receiving large quantities of butter, cheese, eggs and poultry from Eastern states, although these shipments are decreasing, and must ere long cease entirely.

CHEESE PRODUCTION

Although the State has more than trebled in butter production in the last ten years, the cheese production has not kept pace therewith.

Out of fifty-eight counties in the State, fifty-five produced cheese during the year as compared with twenty-four during the previous year. Monterey, Marin, Santa Clara, San Benito and Merced, in the order named, are the leading counties and produce more than one-third of the total output of the State. Comparing the totals for the past twenty years, we have the following:

(Table No. 22.)

Year	Pounds	Year	Pounds
1897	6,399,625	1907	5,328,942
1898	5,148,372	1908	6,162,514
1899	5,394,938	1909	5,931,194
1900	4,989,960	1910	4,648,348
1901	5,681,366	1911	4,380,495
1902	6,503,441	1912	4,785,617
1903	7,218,639	1913	5,600,972
1904	6,133,898	1914	6,016,813
1905	6,020,672	1915	6,349,775
1906	6,418,480	1916	7,745,124

ANNUAL VALUE OF DAIRY PRODUCTS, 1916:

Butter,	70,030,174 lbs.	$19,181,264
Cheese,	7,745,124 "	1,203,592
Condensed Milk, etc.	18,610,336 "	1,488,818
Market Milk and Cream Consumed,		14,000,000
Calves Produced on Dairies		2,500,000
Skim Milk & Butter Milk		1,750,000
Cassin	1,864,317	186,431
		$40,310,105

POULTRY INDUSTRY

Poultry raising in California is a profitable industry. In a more or less practical way it has been carried on in all parts of the State, but in Sonoma, Sacramento, Colusa, Humboldt and San Benito Counties, and to a less extent in some others, the latest scientific methods are generally practiced with gratifying results. The industry is constantly extending, as the demand for poultry products greatly exceeds the home supply. The Turkey-farming, as it is called, is mainly in the grain districts where the fowls can range. Hatching by incubators prevails generally. The largest incubator factory in the world is in Petaluma, and runs to full capacity most of the year.

The average chicken ranch near Petaluma consists of about five acres, upon which are placed 500 to 3,000 hens. There are, of course, larger ranches which maintain 5,000 to 30,000 chickens. A person should have from $3,000 to $5,000 to equip a chicken ranch and get ready for a profitable business. In case of renting, however, about $1,500 is needed to start the prospective poultryman. The average profit on each hen is about $1 per year.

Notwithstanding the remarkable development of the poultry business at Petaluma and other places, the increase is not sufficient to meet the demands of the market. The rapidly expanding population of the State

requires the importation of several million dozen eggs each year from Eastern points, and there is no immediate prospect of the home supply overtaking the market. This fact insures the success of all practical poultrymen who engage in the industry in California.

Petaluma is the principal shipping point of Sonoma County, and the market business done from that point, and its growth, is reflected in the following tables:

(Table No.23.)
SHIPMENTS OF EGGS AND POULTRY FROM PETALUMA.

Year	Eggs Dozen	Poultry Dozen
1906	4,334,331	39,938
1911	8,134,127	80,553
1916	13,101,512	106,032

The above figures represent actual shipments of eggs to market. It is but fair to say that over one and one-half million dozen eggs are produced which are used for hatching and home consumption; these, added to the above, bring the total production of the Petaluma district up to near eight and one-half million dozen, or over 175,000,000 eggs.

It is now a well known fact that chickens and turkeys thrive on alfalfa and need no other source of sustenance except possibly a little corn or wheat fed to them shortly before being shipped to market. Large flocks of chickens and turkeys can thus be maintained on alfalfa at the same time that it is being used to support

(Table No. 24.)

FIELD CROPS---GRAIN. The following table from the records of the U. S. Department of Agriculture shows the yearly production of the four principal grain crops in the State since 1898 and of rye since 1907:

Year:	Wheat Bushels 60 lbs.	Barley Bushels 48 lbs.	Corn Bushels 56 lbs.	Oats Bushels 32 lbs.	Rye Bushels 60 lbs.
1898	12,403,700	12,263,461	1,184,040	1,943,304	
1899	29,666,666	14,046,087	1,536,975	1,845,787	
1900	20,933,333	19,769,760	1,351,975	1,477,771	
1901	28,751,500	26,162,780	1,850,793	4,887,374	
1902	18,759,490	23,489,065	1,839,150	5,148,583	
1903	14,880,990	21,075,000	1,777,162	5,756,964	
1904	10,895,216	24,413,604	1,350,000	5,250,000	
1905	5,660,360	22,094,186	1,204,000	4,735,000	
1906	8,333,330	26,162,790	1,100,000	4,300,000	
1907	10,833,330	25,096,666	1,100,000	4,100,000	1,250,200
1908	11,680,000	25,427,000	1,600,000	6,700,000	792,000
1909	11,550,000	31,270,000	1,740,000	6,280,000	842,000
1910	17,100,000	43,400,000	1,838,000	8,325,000	986,000
1911	8,640,000	40,600,000	1,836,000	7,140,000	136,000
1912	6,273,000	41,760,000	1,924,000	7,800,000	141,000
1913	4,200,000	33,150,000	1,815,000	6,636,000	120,000
1914	6,800,000	42,060,000	2,160,000	7,700,000	136,000
1915	7,040,000	39,440,000	2,624,000	6,963,000	112,000
1916	5,600,000	33,320,000	2,048,000	6,500,000	104,000

cattle or hogs, a large part of the food of these fowls being the bugs and insects attracted by the growing crops.

GRAIN CROPS

The yield and values of the cereal crops sown for the harvest of 1911 and 1916 as given by the Department of Agriculture, are as follows:

(Table No. 35.)

1911:

	Bushels:	Value:
Wheat	8,640,000	7,603,000
Barley	40,600,000	34,510,000
Oats	7,140,000	4,213,000
Rye	136,000	116,000
Corn	1,836,000	1,652,000
		$ 48,094,000

1916:

Wheat	5,600,000	8,512,000
Barley	33,320,000	31,654,000
Oats	6,500,000	4,680,000
Rye	104,000	121,000
Corn	2,048,000	2,540,000
		$ 47,507,000

HAY AND FORAGE CROP

The hay crop of California is one of the most valuable agricultural products, being each year since 1905 worth over $31,800,000. Alfalfa is increasing yearly in acreage and value. From three to eight cuttings may be made yearly on irrigated ground, with an aggregate yield of from four to twelve tons to the acre.

Estimates based on returns made by the county statisticians and others give the yield and value of the hay crop since 1905, as shown below:

(Table No. 26.)

	Yield:	Value:
1905	3,697,373	$31,687,180
1910 (grain & grass, hay & alfalfa)	3,786,250	36,148,000
1911 "		42,352,000
1912	3,825,000	53,402,000
1915	4,230,000	47,376,000
1916	4,375,000	55,125,000

Returns of county assessors to the State Board of Equalization credit the various counties with 862,534 acres of standing alfalfa, which from the several cuttings yielded 1,838,000 tons, which at the farm value used by the Department of Agriculture, $9.60 per ton, would be worth $17,544,800.

BEANS AND OTHER FIELD CROPS

California is famous for the production of dried beans, onions, potatoes, etc., and they add much to the resources of the State. From the "Crop Reporter" and leading authorities in handling these products the following figures are obtained of product and values for 1916:

(Table No. 27.)

Product:	Quantity:	Farm Value at Harvest Time:
Lima Beans	1,815,000	$8,349,000
Pink Beans	825,000	4,207,500
Small White Beans	750,000	5,737,500
Other Varieties	250,000	850,000
Total Beans	3,640,000	$19,144,000

(Table No. 37 cont'd.)

	Quantity:	Farm Value at Harvest Time:
Sugar Beets	1,439,000	9,387,160
Onions	1,400,000	3,400,000
Potatoes, Irish	10,575,000	14,805,000
Potatoes, Sweet	800,000	1,200,000
Field and Garden Seeds		2,500,000
		$68,460,160

HOP CROP

The hop crop in California, as elsewhere, varies greatly from year to year, influenced mainly by market prospects. The crop of 1910, according to statistics furnished the California Development Board, was 71,511 bales of 185 pounds each, or 13,229,535 pounds. Sonoma and Sacramento Counties lead in the production.

(Table No. 38.)

HOP PRODUCTION IN CALIFORNIA
1889 - 1916

Year:	Bales:	Pounds:	Year:	Bales:	Pounds:
1889	35,230	6,517,550	1903	57,000	10,545,000
1890	28,130	5,204,050	1904	63,000	11,655,000
1891	36,151	6,687,935	1905		13,135,000
1892	39,800	7,363,000	1906	108,000	20,000,000
1893	51,400	9,509,000	1907	90,000	16,650,000
1894	67,500	12,287,500	1908	63,200	11,692,000
1895	52,000	9,620,000	1909	69,688	12,892,280
1896	35,000	6,475,000	1910	71,511	13,229,535
1897	45,000	8,325,000	1911	95,981	17,768,485
1898	44,000	8,140,000	1912	117,770	21,198,600
1899	59,000	11,210,000	1913	130,000	24,200,000
1900	38,000	7,230,000	1914	100,000	18,500,000
1901	48,000	9,120,000	1915	115,000	21,275,000
1902	53,500	10,165,000	1916	116,500	21,553,500

BEET SUGAR

The best sugar industry of the State grows yearly in importance. In 1909 California produced over

38 per cent of the total product of the United States and was second only to Colorado in output. In 1910 with an increased acreage and very favorable growing conditions, it surpassed all previous records and took the first place, with a production of 144,746 tons. Michigan, the nearest competitor, followed with 112,100 tons, and Colorado, the late leader, came third with 98,560 tons. The beet sugar production for the whole United States for 1910 was 498,400 tons, of which California produced nearly 30 per cent.

In 1911-12 the acreage in California was about 101,000 the yield over 1,000,000 tons of beets and the output 162,538.4 short tons of sugar, leaving it in the lead of the beet sugar producing states with 35 per cent of the total production of the United States 572,415 tons.

For the campaign 1915-16 California had 144,200 acres, and produced 1,439,000 tons of beets, with a sugar output of 236,385 tons.

The existing factories and their locations are as follows:

Spreckels Sugar Co., Spreckels, Monterey County.
Spreckels Sugar Co., Watsonville, Santa Cruz County.
American Beet Sugar Co., Oxnard, Ventura County.
American Beet Sugar Co., Chino, San Bernardino County.
Alameda Sugar Co., Alvarado, Alameda County.
Union Sugar Co., Betteravia, Santa Barbara County.
Los Alamitos Sugar Co., Los Alamitos, Orange County.
Southern California Sugar Co., Santa Ana, Orange County.
Sacramento Valley Sugar Co., Hamilton, Glenn County.
San Joaquin Valley Sugar Co., Visalia, Tulare County.
Pacific Sugar Co., Corcoran, Kings County.
Anaheim Sugar Co., Anaheim, Orange County.
Holly Sugar Co., Huntington Beach, Orange County.

California was the pioneer in the beet sugar industry of the country. The first plant operated in the United States was the one at Alvarado, Alameda County. The plant at Spreckels, in Monterey County, is the largest beet sugar factory in the world.

The average yield of sugar beets per acre and the average percentage of sugar in California beets is greater than in Colorado or Michigan. In some parts of California the soil and climatic conditions are superior for the cultivation of sugar beets. The large average percentage of sunlight is probably the main factor in the results obtained.

The growth of the industry in California is shown in the following exhibit for twenty-five years, beginning with 1888, that being the first year that statistics were obtained and published by the State Board of Trade.

(Table No. 29.)

BEET SUGAR PRODUCTION OF CALIFORNIA

Tons of 2,000 pounds.

Year:	Tons:	Year:	Tons:
1888	1,910	1903	65,360
1889	2,457	1904	59,147
1890	3,351	1905	64,351
1891	5,234	1906	94,385
1892	10,761	1907	72,889
1893	17,420	1908	99,613
1894	18,615	1909	126,621
1895	23,827	1910	144,747
1896	31,815	1911	163,538
1897	35,380	1912	155,432
1898	18,086	1913	169,358
1899	43,100	1914	168,732
1900	30,319	1915	303,200
1901	68,700	1916	236,385
1902	73,761		

SUMMARY

Summary of the farm values of products of the soil for 1916, marketed by the producer and for the most part shipped out of the State. Consumption by producers not included except in case of animals slaughtered for consumption by rural population.

Compiled for data gathered from transportation companies and other authoritative sources.

(Table No. 30.)

	Value	Total Values
Orchard Products:		
Fresh deciduous fruits, including apples	$28,000,000	
Citrus Fruits	40,000,000	
Dried Fruits, not including prunes or raisins	11,000,000	
Prunes	8,000,000	
Canned fruits and vegetables	30,000,000	
Olives and olive oil	3,500,000	
Nuts	5,000,000	$115,500,000
Vineyard Products:		
Table grapes	11,000,000	
Raisins	15,000,000	
Wine and Brandy	14,500,000	40,500,000
Garden Products, fresh		12,000,000
Dairy and Poultry Products:		
Dairy Products	40,310,105	
Poultry Products	20,000,000	
Honey, Wax, etc.	1,200,000	61,510,105
Farm Products:		
Barley	31,654,000	
Wheat	8,512,000	40,166,000
Forward		$257,676,105

		Total Value
Brought forward.		$357,676,105
Farm Products (Cont'd)		
Oats	4,680,000	
Corn, rye	3,381,000	
Rice	3,544,000	
Grain, grass, hay and alfalfa	35,185,000	
Hops	3,000,000	
Sugar Beets	35,000,000	94,010,000
Other Field Crops		
Potatoes	14,805,000	
Potatoes, sweet	960,000	
Beans	20,875,000	
Onions	4,000,000	
Seeds and sundry other	3,000,000	
Melons	4,000,000	
Cotton	750,000	48,390,000
Farm Animals and Products (other than dairy)		
Wool on Farms	2,200,000	
Livestock	37,000,000	39,200,000
Sundry Others, not included above		
Nursery and Florist Products	5,000,000	
Cider, vinegar, etc.	2,500,000	7,500,000
		$458,776,105

The census returns for 1910 gives total improved area as 11,380,000 acres. On this basis the yield per acre would thus be approximately $40.

The census of 1910 gives the following comparisons as to farm lands in California:

Number of farms, 87,670. Increase in ten years 15,128. Average size 318 acres. Total acres 27,883,000 of which 11,380,000 acres are improved. These figures

include, of course, grazing lands, mountain slopes, and all areas not government land, and include a great deal of land that in this report is not considered farming land. Total value of land and buildings 1910, $1,448,560,000 an increase over 1900 of $740,647,000 or 105 per cent.

Average value of land and buildings 1910, $51.95; in 1900, $24.56; gain 112 per cent. Land alone was worth $47.19 as against $22.56 in 1900, a gain of 116 per cent.

Total number of farms mortgaged, 36,870 or 40 per cent.

Expenditure for farm labor 1910, $49,375,000 as compared with $25,845,000 in 1900, an increase of practically $2,000,000 per month or 92 per cent.

CHAPTER IV.

S A C R A M E N T O V A L L E Y

Early Efforts At Development

SPANISH AND MEXICAN RULE

(2) "During the nearly eighty years of Spanish and Mexican rule in California the Sacramento Valley was the abode of Indians, wild animals, and an occasional white trapper. Its transformation into cultivated fields was the work of Anglo-Saxons. Were it not for the large tracts of land on the borders of the interior streams, which were given away under both Spanish and Mexican rule, little would remain to indicate the influence of that period. Neither the upper portion of the great central plain, known later as the Sacramento Valley, nor the lower portion now designated the San Joaquin Valley, received any benefit agriculturally from the chain of Missions which were established along the coast from San Diego on the south to San Francisco on the north. As late as 1850, a forked limb of a tree shod with a piece of iron and drawn by oxen hitched by the horns served the purpose of a plow. The harrow was a bundle of brush, the reaper a sickle

or a knife, and the thrashing machine the hoofs of young horses."

EARLY LAND GRANTS

(2) "From an agricultural point of view, the first half of the nineteenth century in California is important chiefly as being the period of the Spanish and Mexican land grants. Before the termination of Spanish rule, in 1822, about thirty ranches or farms had been granted. As a means of colonization under Mexican independence the number was greatly increased, and in 1846 no less than eight hundred large tracts containing some of the best land in the State had been given away. These land grants have from that day to the present exerted powerful influence in shaping the destiny of the Commonwealth. At the cession of California to the United States in 1848, there were comparatively few Spaniards or Mexicans north of San Francisco, and the influence of these, outside of a few prominent individuals like General Vallejo and Senor Martinez in the Coast region, was not sufficient to make any lasting impressions. In no sense is this true of the land grants along the Sacramento River and its tributaries. These have so controlled the agricultural as well as the commercial and social development of that part of the State that it would not be possible to convey to minds unfamiliar with the situation a correct idea

of the irrigation conditions and possibilities of this valley without some reference to the size and character of the land holdings.

(Table No. 31.)

Spanish and Mexican Land Grants in Sacramento Valley

County	Number of Land Grants	Total Acres
Yolo	5	91,970
Yuba	3	78,653
Colusa and Glenn	6	156,262
Sacramento	8	302,330
Butte	8	149,881
Solano	8	146,379
Sutter	2	23,545
Tehama	7	131,379
T o t a l	47	980,399"

(2) "The above summary shows that prior to 1848 grants aggregating 980,399 acres had been made to residents of the nine counties in the Sacramento Valley. The number given in the table is slightly in excess of the number of original grants for the reason that a few were subsequently divided by county lines. Thus, for example, the Capay grant to J.Soto, comprising 41,388 acres, was cut in two by the north boundary of Glenn County. This political division left 20,388 acres in Tehama County and the balance in Glenn County."

AMERICAN EXPLORATION

(3) "The first authentic records of exploration are those of Gen. John Bidwell, who, in 1843, while

in the service of General Sutter, of Sutter's Fort, on the site of the present city of Sacramento, traversed the entire valley. The following year several grants of large tracts of land, covering parts of the river bottom and lower valley plains, were secured from the Mexican Government. During this year General Bidwell returned and located, southeast of the site now occupied by the town of Willows, a large grant known as "Larkin's Children's Rancho" for Thomas O. Larkin, of Monterey. Upon this grant the first dwelling was erected in 1846. In 1845 Bidwell secured for himself a grant of two square leagues of rich alluvial land at the site of the town of Chico, on the Sacramento River, then occupied by a thriving village of native Indians of the Colusa Tribe of Diggers."

EARLY CROPS

(4) "The first crops were grown along the Sacramento River and consisted of corn, sweet and Irish potatoes, melons and other vegetables, and hay. The luxuriant growth of wild grasses on the plains of Yolo and Colusa Counties and the mild climate of the region were favorable to stock raising, and this industry grew to great proportions between 1850 and 1862. The common cattle were of poor quality, being the Mexican long horn type. Prior to 1860, however, a considerable number of American bred cattle were

brought across the plains from the East. Stock raising continued to be the principal occupation of the settlers until the years of 1862 and 1863. During these two seasons a prolonged drought occurred, which caused a scarcity of pasture on the plain, and as a consequence a large number of stock perished. This resulted in a great loss to the cattlemen and brought about a change in agricultural practices and hastened the development of new industries."

(5) "The first sowing of wheat was made upon the rich alluvial soil of the river bottom, producing a yield of 40 to 50 bushels to the acre. With success in the raising of stock and the growing of hay, barley, and wheat, ranches multiplied and settlements sprang up in the vicinity of the Sacramento River."

RAILWAY TRANSPORTATION

(5) "The ranches and rural settlements were gradually extended from the river bottoms to the valley plains. It was not, however, until the stimulation caused by the coming of the Northern Railway, now the Southern Pacific in 1873, that present Valley points within the so-called Colusa area assumed importance. Then a great part of the river settlements, business houses, dwellings, and population were transferred bodily to the railroad points and dry farming to grain in extensive tracts developed rapidly."

(5) "It is the invention of modern labor-saving machinery and the general use of the gang plow, throwing from 6 to 8 furrows and drawn by an 8 or 10 mule team, the wheeled broadcast seeder or grain drill, and the combined harvester introduced in 1890 and hauled by 36 to 38 mules or horses, cutting, thrashing, screening, and sacking the grain at one operation, that has rendered this extensive system of agriculture - the general type of farming to the present day -- possible or profitable. With improvement in the efficiency of farm machinery the capacity of operating over still larger tracts by use of the same equipment increased. The large holdings grew larger through the acquiring of small tracts operated by less successful farmers, who were often ruined by a single unfavorable season."

(5) "During the period of maximum production the quantity of wheat and barley produced in this section was enormous. Upon the holdings of the late Dr. Glenn, occupying some 46,000 acres near Jacinto, nearly 1,000,000 bushels of wheat is reported to have been grown in a single season. Large barges were, and are still, loaded with the sacked grain and floated down the river to San Francisco from this and adjacent river points, in tow of stern-wheel steamers. In addition, large shipments are made by rail from

warehouses established in various parts of the valley. More than 50,000 tons of grain have been shipped from some places in a single season."

(5) "The success attained in the production of grain under an extensive and inexpensive system of agriculture, without regard to the principles of rotation of crops, and with little attention to thorough culture or application of farm manures or of other fertilizers, has not been without its injurious and depressing effects. In the handling of large tracts under such a system, the matter of preparing and seeding the greatest possible area in the least possible time and at the least expense, rather than that of thorough cultivation and larger yields on more limited areas, has been the leading factor in success. Such methods, though perhaps necessary under economic conditions, ultimately lead to deterioration in the productiveness of the soil."

(5) "Summer fallowing was early adopted as a means of securing increased yields. Under this practice, one-half of the land lies idle during the growing season. Upon the most of the fallowed tracts, however, the land is merely plowed and rarely is any attempt made by subsequent cultivation to conserve the moisture for the following season. Notwithstanding the fallowing of the land every second year, the continued production of the one crop of wheat or

barley has resulted in decreased yields. This has in turn given rise to failures, depreciation of land values, and to an increase in the number of mortgaged farms."

SMALL FARMS ABSORBED

(5) "As the farmers of limited capital were forced to abandon the land, their small holdings were rented or absorbed by the owners of the more extensive tracts who could afford to operate for the narrow margin of profit allowed by decreasing yields and prices, and further concentration of the farming lands in great estates was effected, with corresponding decrease in population. This is brought forcibly to the attention of one traveling over the roads in the great valley district. Numerous small bunches of trees mark the point where once stood a house, the home of a small farmer. Today these families are scattered, and the small ranch is only a small fraction in a great farm of perhaps 10,000 to 30,000 acres owned by one person and farmed by a drifting population employed only during the planting and harvesting season, and having no interest in the welfare of the country except in obtaining a few weeks' wages, which may or may not be spent in the neighboring towns. According to the United States census for 1890 and 1900 this section of the Sacramento Valley, except in Tehama County where a colonization project

brought the country a trifling increase in population in that decade, had decreased in population more than 13 per cent and the average size farm in Glenn and Colusa Counties is given in the statistics for 1900 as 1,091.4 and 945 acres respectively."

(5) "Many of the farm dwellings in these extensively dry-farmed districts are remote from neighbors, the post-office, public schools, or public highways, and are often of cheap construction. The farmsteads are frequently without shade or fruit trees, shrubbery, or the usual vegetable garden of eastern or irrigated districts. Instead of growing them, fresh fruits and vegetables are purchased from the Chinese vegetable vender, who makes regular trips through the country, for many miles, with the product of his small irrigated and intensively cultivated vegetable patch, which is located in the vicinity of the small towns or even at some distance outside the area. In the dry-farmed districts of the more productive and better drained soils, however, particularly west of Willows and Maxwell, and in the south-western part of the area, substantial and attractive farm buildings prevail. In 1892 the late W. H. Mills estimated that the holdings of 100 proprietors in the Sacramento Valley aggregated 1,600,000 acres, or an average of 16,000 acres to

the landlord. The year previous, William Ham Hall, Ex-State Engineer, in a report to the Central Irrigation District, located in portions of Glenn and Colusa Counties, stated that 40 owners held 89,000 acres of the total of 156,550 acres comprised in the district, yet this district when compared with the entire valley, if one excepts a few large ranches, was one of small rather than large holdings. This condition continued largely unchanged until the opening of the 20th Century."

CHANGES NOW OCCURRING

(2) "The Valley is now in a transitional stage. Several of the large grain ranches have been sold to land and irrigation companies which have provided, or are proceeding to provide, a water supply. As soon as this is done the land is subdivided and sold to settlers in small holdings. These sales mean much more than ordinary land transfers. They involve a radical change in crops, farming operations and methods, and the breaking up of the great so-called Bonanza wheat farms. The new man on the small farm cannot afford to raise grain. In order to make a living he must grow alfalfa, fruit, and vegetables, and as a rule these must be irrigated."

(5) "While extensive irrigation of the valley plains has been discussed and irrigation works have

been partially completed at great expense, progress in irrigation and intensive agriculture has been blocked by engineering difficulties, litigation, and the indifference and opposition of the land owners themselves, who here, where grain can still be produced at a small profit, prefer in many cases to continue the direction of uncertain farming operations over an estate of one to many thousand acres rather than to take up the management of a smaller irrigated farm. In consequence this section of the Sacramento Valley, as stated in the publication already cited, while possessing greater natural advantages than some of the rich, intensively irrigated districts of Southern California, has developed but a fraction of its productive capacity. Gradually the transformation has occurred; first, of the Spanish grants of grazing tracts enormous in size; next the wheat kings' farming areas almost equally great without irrigation, and requiring but scant population to plant and harvest the crops; and last, the present approaching era of the farm intensively cultivated by irrigation, where the owners may on 20 to 40 acres raise a family, live in comparative luxury and put money in the bank year by year."

To accomplish this last revolution means the expenditure of vast sums of money to make irrigation water available, prepare the land and to plant

it, and erect suitable buildings to house the owner and his stock. What the cost will amount to, and what the returns to be secured will be, will be discussed in the following portions of the report.

CHAPTER V.

IRRIGATION IN THE SACRAMENTO VALLEY

NECESSITY FOR IRRIGATION

It is to-day accepted as axiomatic that the further agricultural development of California is dependent upon irrigation. Seasonal conditions may be divided into two parts, the wet and the dry. Commencing in November and extending often into April and May is the period during which storms occur, comprising rain in the valleys and low foothills, and snow in the high Sierras. From May until the following December the sky is almost constantly cloudless; rain falls in negligible quantity and the green hills and valleys become brown and parched. If it were not so, if the two seasons did not alternate in this manner, we should have a country far different from California as we know it; Fresno would not be the center of a great raisin industry; fruit would not be dried in the open as it is now; and conditions would obtain more nearly approximating those of the eastern states.

PAST EXPERIENCE

(7) "Irrigation in California has undergone tremendous vicissitudes during the past forty years. Laws have been inadequate to safeguard the use and appropriation of water; pitiful ignorance has been shown in planning and constructing irrigation systems.

Farmers of no experience or training have been entrusted with the expenditure of large sums with disastrous results. Out of it all, however, has grown a mighty industry irrigating 3,192,646 acres out of a possible 9,699,600 and certain axioms of irrigation have been established beyond cavil."

AREA IRRIGATED

In Bulletin 254, Office of Experiment Stations, U. S. Department of Agriculture, "Irrigation Resources of California and Their Utilization", are outlined irrigation resources of the State. The agricultural and irrigated areas are listed for 335 separate valleys or units, and the total area of irrigable agricultural land found in the zones of irrigation water supply, which includes all of the valley lands, the rolling plains of the Great Valley, the arable portions of the Sierra foothills up to about 3,000 feet in elevation, and all of the plateau and desert lands to which some irrigation water supplies are available, is estimated at 21,865,200 acres. Of this, 3,200,000 acres are already irrigated and 9,700,000 acres estimated as the area which will probably be ultimately irrigated.

Of the total irrigable areas, it is concluded that 28.5 per cent are in Northern California, 44 per cent in Central California, and 27.5 per cent in

Southern California. 15 per cent of the total irrigated area is in Northern California, 61 per cent in Central California, and 24 per cent in Southern California. Of the areas which it is believed may ultimately be irrigated, 35.5 per cent are in Northern California, 44.5 per cent in Central California, and 20 per cent in Southern California. Of the estimated future increase in the irrigated acreage of California about 45 per cent is allotted to Northern California, 36.5 to Central California, and about 18.5 per cent to Southern California.

About one-fifth of all the present irrigated land in the United States is in California and it has been estimated that the Sacramento and San Joaquin Valleys alone contain one-tenth of all the land of the United States possible of irrigation. Adding to this the irrigable land of Southern California, including the Imperial Valley, of the coast counties and of the Sierra Nevada foothills, it is quite likely that a seventh or an eighth of all of the land possible of irrigation in the United States will be found to lie within the confines of the State of California. It is also a fact that the highest priced irrigated lands in America are found in this State. In no other place in the world has water for irrigation reached so high a value or been so carefully or economically used.

(1) "The existing irrigation systems cover 4,000,000 acres, one-tenth of which is served by pumping plants and artesian wells and the balance from stream diversions. These include the valley lands along the Coast from the Mexican border to and including Ventura Co.; the Imperial and Coachella Valleys in the Colorado Desert; a few isolated areas in the western portion of the Mojave Desert; the Santa Maria, Owens, Salinas, Pajaro, Santa Clara and Honey Lake Valleys; an extensive area east of the trough of the San Joaquin Valley, with a narrow strip on the west bank of the San Joaquin River; scattered areas throughout the Sacramento Valley, and some patches along the upper Pitt, Scott and Klamath Rivers."

PROGRESS OF IRRIGATION

(3) "Irrigation, like any other development, has followed the lines of most evident financial returns, hence the localities of least annual and summer rainfall were the first to be reclaimed by the artificial use of water. The tide of irriga-

tion, however, has been moving steadily northward, and, excepting in the mountainous sections and the sections of excessive rainfall, the necessity for irrigation, or at least the value of it where it is not a complete necessity, is almost universally recognized. While heretofore, then, irrigation has followed the line of most evident return, in the future it will follow the available water supply."

LARGE CAPITAL A NECESSITY

(7) "It is customary to think of the farmer as one needing little capital. This may have been true in past years as applied to farms in the Middle West, but it is not true of irrigated farms in California. We have been accustomed to regard agriculture as a non-capitalized industry, and much loose talk has been indulged in about farmers creating homes in the arid West by their unaided efforts as they formerly did on the prairies of Illinois and Iowa. Those who attempt this find scenery and mountain air a poor support while building flumes and digging ditches. This misconception of the preliminary outlay required

has caused much serious hardship to individuals, and has stood in the way of enacting proper laws. Everyone recognizes the need of capital and organization in the building of railways. There is no one who does not appreciate the necessity for money in starting a factory, and who would not recognize the absurdity of a hod-carrier trying, without aid, to erect a six-story block; yet many insist that the equally costly and more difficult construction which must precede the watering of arid lands can be carried to completion by home-seekers without either money, organization, or technical acquaintance with the problem to be solved."

COMPARISON WITH SOUTHERN CALIFORNIA

"In Southern California the tremendous development is due entirely to irrigation, and the cities of Los Angeles, Pasadena, Riverside and Redlands are as truly the products of irrigation as the orchards that surround them. In fact, we may safely say that for a quarter of a century irrigation has been the leading factor in the growth of the western two-fifths of the United States."

"It is disappointing in view of this to observe the backwardness of irrigation in Northern California. The casual observer has not been able to account for the wide stretches of brown summer fallow

and the poor crops of grain when such high profits might be made under more intensive farming, plus irrigation. The reasons are not difficult to find. Its very advantages in the way of fertile soil, winter rains and favorable climate have held it back. Had the soil been poorer, the rainfall less and the climate colder, irrigation would now cover the entire valley. Holdings of land were enormous, grain could be grown with profit, and the owners were under no necessity to sell and saw no practical way of irrigating several thousand acres and at the same time holding possession. Some efforts at cooperative ditches had proved disastrous, and so the land was farmed for wheat in large tracts until constant cropping has made the land in many sections no long fitted for wheat growing."

"For purposes of comparison between areas in California irrigated and those farmed dry, Riverside may be taken as a typical example of development of irrigation. Other similar districts could be referred to."

About 22,000 acres are irrigated around Riverside, 17,000 acres in citrus fruits, and 5,000 in alfalfa and other crops. Three hundred wells have been sunk to supplement gravity supply to irrigate these lands, by which the water supply has been maintained in volume as large as during periods

of abundant precipitation. Starting with a sheep pasture, assessed under protest at 75 cents per acre in 1870, this district now supports in comfort, if not luxury, about 16,000 inhabitants, or a citizen in every 1.37 acres irrigated, and shipped over 6,000 carloads of citrus fruits during the season of 1910. The value of this crop was $350 per acre gross on the better irrigated area, and the output is rapidly increasing. The City of Riverside has 5 banks, 28 churches, and 13 school-houses. The post-office receipts in 1910 were $54,300. The amount of its bank deposits $5,730,000, and assessed valuation, $8,500,000, make it perhaps the first city of its class in the United States.

On the other hand, consider Glenn County, lying in the upper portion of the Sacramento Valley and principally upon the western side of the Sacramento River. It has so many natural advantages that if its valley lands were divided into small farms and irrigated it probably could be made one of the most productive and densely populated agriculatural counties in the State of California. It is today, aside from its irrigated areas, confronted with a decreasing population and a decreasing assessed valuation, as the result of dry farming. With natural opportunities greater than any that exist in Southern California, it has not reached one per cent of

the development which is possible.

(7) "From an agricultural standpoint the difference between Northern and Southern California is irrigation. All that has been accomplished in the latter can be more than duplicated in the former. Nevertheless, no state has gained more than California from the artificial application of water, or has more at stake in the extension of its use. It is only through its magic that all of the possibilities with which the State is so generally endowed can be brought into full fruition. Through irrigation, midsummer can be made almost as lovely as spring. It removes or lessons the dust and discomfort of the rainless season and makes it possible to create rural homes which on the whole represent an average of human comfort hardly to be equalled elsewhere in this country. It completes the marvelous combination which makes winter a season of seed-time instead of stagnation, which gives to the farmers many of the products of the tropics with the climate of the temperate zone, which withholds moisture when it is not needed and thus relieves the husbandman of the most serious vicissitudes of humid districts. This is an aggregation of advantages which those who live elsewhere find it hard to believe exist, and which at home is not everywhere fully appreciated."

(7)***In order to realize what irrigation will do for the Sacramento Valley one must go to the southern part of the State, where lands which were once not worth $10 an acre have by irrigation been made worth $1800 an acre, where water which once ran unused to the sea now sells for $1250 for a single inch, where the yearly cost of water on an acre of land has at times exceeded the purchase price of an acre of first-class farming land in Iowa. The citrus industry, which affects not simply southern California but the markets of every important city in the United States, is the creation of irrigation; but great as it is, it is not the chief benefit which irrigation has brought to this part of the State. A large gain has come from the beautiful landscape which these cases of fruit and foliage present and which have done as much to create the cities of Los Angeles, Riverside, Redlands and Pasadena as their delightful climate.***

"Irrigation in Northern California is of more importance for the possibilities than its achievements. For nearly half a century the greater part of the land of this region has been devoted to the unremitting production of cereal crops. Each year the grain has been shipped away and the straw burned. Little or nothing has been done to restore the fertility of the soil. Although this surprising drain has

gone on for fifty years, it cannot continue forever. There must be a change; rotation of crops must be introduced both to maintain the fertility of the soil and to render irrigation less hazardous and more profitable. Such rotation is not possible by rainfall alone. There is neither enough water nor is it rightly distributed. While the dry season is one of the State's greatest advantages when combined with irrigation, it is a great obstacle when agriculture is attempted without irrigation's aid. It is possible to make California one of the richest agricultural states in America, but to do this requires that every river shall be diverted, that the floods shall be stored, and that every drop of the available supply shall be used."

(7) "The following description does not overstate the possibilities of the Sacramento Valley:

> 'We have here a country of marvelous possibilities, a soil rich in all the elements of plant growth, with surface smooth and easy of tillage, a climate whose summer heat and winter cold are tempered by the breezes of the Pacific, so equable that here all the choicest products of the temperate zone and of the subtropics are grown alike in perfection. Here flourish side by side the apple, the peach, the pear, the plum, the apricot, and grape, along with the orange, the lemon, the lime, and the fig. Here the oak and the pine, there the palm and the pepper tree. The roses bloom winter and summer. The orange carries its fruit through the winter; the oleander is a tree.'"

(7) "To make use of these resources irrigation is necessary. The natural rainfall of the country will not answer. The land that is irrigated is worth from two to four times as much as the unirrigated land which adjoins it."

(8) "The highest priced and most productive farm lands on this continent are in California and in the region where irrigation is practiced. It has only of late years become generally recognized that irrigation is a necessity in the Sacramento Valley equally as much as in Southern California, to accomplish the greatest results, and that a careful use of water even at high cost far more than repays the farmer."

(9) "For centuries the valley of the Po in Italy has been under irrigation. Comparing the annual average rainfall at Milan with that of the Sacramento Valley will show interesting results."

(Table No. 32.)

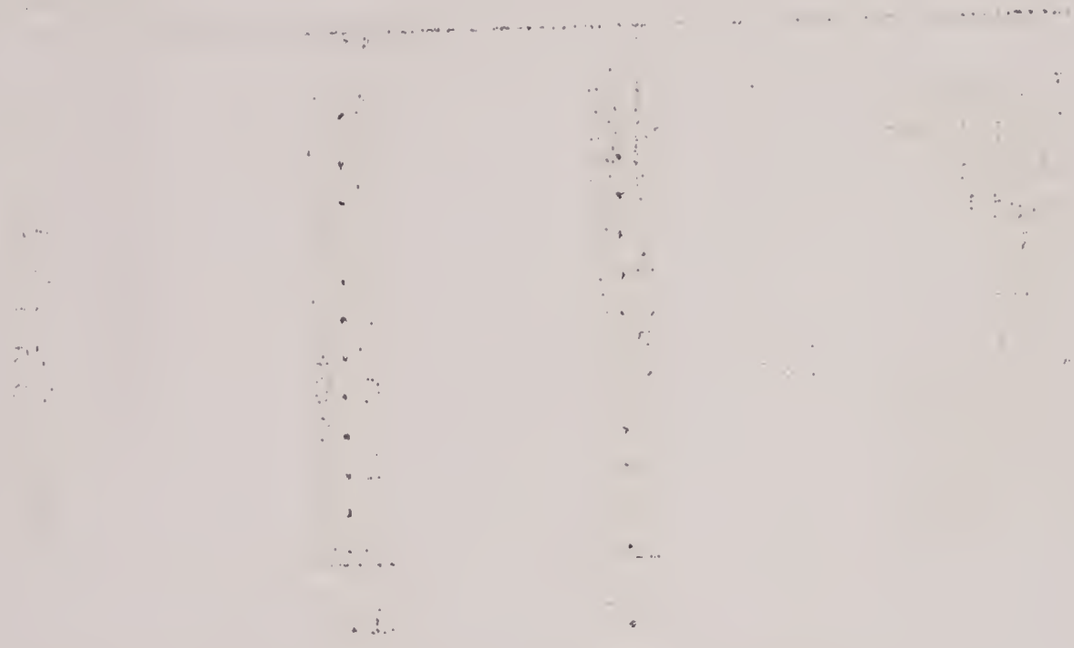
RAINFALL

In Inches.

Month	MILAN Average of Eighty Years	SACRAMENTO VALLEY Average of Twenty-four Years	TEMPERATURE OF SACRAMENTO VALLEY Average Five Years, Degrees Fahrenheit
January	2.3	4.0	48°
February	2.3	2.9	51
March	2.8	2.8	54
April	3.6	1.6	58
May	4.0	1.1	66
June	3.3	0.5	75
July	2.9	0.1	78
August	3.7	0.2	79
September	3.8	0.4	71
October	4.4	1.2	65
November	4.2	2.8	55
December	2.8	3.4	47
	40.1	21.0	

With an annual rainfall double that of the Sacramento Valley, Italy with the experience of centuries finds irrigation profitable. Must not we reach the same conclusion with regard to the Sacramento Valley?

Of all sections of California none is so blessed with abundant water for irrigation as is the Sacramento Valley. The estimated storage capacity of the available reservoirs totals about 6,500,000 acre feet.



The total area in the Sacramento Valley which can be considered topographically situated to receive water is, in Bulletin 254, estimated at 3,450,000 acres, and the conclusion is therein reached that while water may not be economically available to all of the area under present standards of use and costs, none of it really should be eliminated as being plainly outside of the reach of water. 1,000,000 acres are in the upper line of permanent or temporary overflow, with 800,000 acres naturally covered by every considerable flood. "Assuming the ultimate protection of all the present overflow land, but eliminating the estimated 250,000 acres that will still remain in river and by-pass and other drainage channels after flood protection is accomplished, and further reducing the irrigable area on account of roads, towns and other uncultivated patches, the irrigable area of the valley probably approximates 3,500,000. It is believed that this area can be considered fit for irrigation and that water for irrigation is now or will be made available for it."

IRRIGABLE AREA AND COST: GRAVITY AND PUMPING

(2) "It is estimated that the Sacramento Valley contains 3,600,000 acres of irrigable land. It has been estimated that the cost of preparing the land

for irrigation and building the farm ditches and the structures necessary for the control and use of water would average $12 per acre, or $35,000,000 for the entire valley and that under existing conditions this land is not supplying more than one-tenth of the revenue of which it is capable. To successfully control and use the water to irrigate this land will cost $20 per acre, or $50,000,000. It will require $14 per acre or $35,000,000 to prepare the farm land for irrigation, or a total of $85,000,000, or $35 per acre on 2,500,000 acres."

And were this not sufficient, the enormous area of underground gravel beds deposited in past eras by these same streams or their predecessors, the flow of which, according to Le Conte, was ten times the present flow of California Rivers, afford underground storage reservoirs, the water plane in which stands at from fifteen to one hundred feet below the surface. These reservoirs can be tapped at small cost by means of wells, and by utilizing the cheap electric power now so abundant in California, can be pumped at comparatively small cost. It is quite possible that in many localities water will be so pumped, at costs per acre-foot less than it can be secured by gravity, all costs of installation and maintenance considered. In solving this

question, cheap electric power will be the dominant factor.

SUPERABUNDANCE OF WATER IN SACRAMENTO VALLEY

Compare this superabundance with the general situation through the arid west wherein only 10 per cent of the land can be irrigated. To succeed, irrigation must have ample water at command at cheap price per acre irrigated.

(7) "Only calamity can come from trying to extend the limits of settlement beyond the possibilities of known and assured water supply."

In respect to water supply and to land susceptible of irrigation at small cost with the maximum return, the Sacramento Valley stands unique. Water in abundance, land of highest quality, coupled with winters without snow or ice and of even little frost, comprises a combination of assets impossible of duplication.

CHAPTER VI.

RECLAMATION OF SACRAMENTO VALLEY

A report on conditions in the Sacramento Valley would fail in presenting an adequate picture did it not include some comment on the problem of reclamation.

UPBUILDING OF THE RIVER

The Sacramento River in its course through the valley does not occupy the lowest depression. Through past years, and especially during the period of hydraulic mining from 1852 to 1880, the river has gradually filled its bed with silt and debris, until today its level is in places well above the surrounding country, causing the land to slope up to, rather than down to, the waters edge.

THE GREAT BASINS

The areas of the greatest depressions are known as basins, and comprise with the low delta lands of the Sacramento and San Joaquin a total acreage of approximately 800,000 acres that is subject to innundation in times of considerable flood,and 1,000,000 acres subject to overflow from extraordinary floods. The cities of Stockton, Sacramento, Marysville and Colusa are all behind levees, a condition in a measure analogous to the cities of Holland.

EARLY RECOGNITION OF NECESSITY OF RECLAMATION

It has been recognized from the time of the great flood in Sacramento in 1852 that the control of the flood water of the Sacramento, Feather, Yuba and American Rivers and of Cache and Putah Creeks was not only desirable but must be eventually accomplished if the ultimate value of the Sacramento valley lands was to be attained.

The early efforts consisted in protecting the more important towns with levees; following which, reclamation of large tracts in the delta districts was undertaken as private enterprises, and without any concert of action looking to the final solution of the problem from Chico to Suisun Bay.

ISLANDS OF DELTA AREA

By degrees, levees have been thrown up around large tracts locally known as "Islands", and an extremely important and profitable agricultural area has been created. Because of the fertility of the soil, ease of irrigation from the river, proximity to San Francisco, and unsurpassed transportation by water, this land finds a ready market as renting land. Rented for cash it commands $35 to $40 per acre per annum and on shares as much as $50 to $75 in crop value. Because, however, of liability of flooding, its sale price is comparatively low; ranging from $100 to $200 per acre, depending on the character of the levees. In some cases where

protection is unquestioned values range as high as $500.

Freed from the menace of floods this land would readily command $500. per acre and would earn 20% per annum on such valuation. As examples, Sherman Island and Ryer Island withstood the flood of 1907, but Jersey and Bouldin were entirely submerged. Jersey has been again reclaimed at a cost of approximately $50 per acre. Bouldin, on which was located one of the most prosperous asparagus plants on the river, is still submerged. Prior to the flood, land on Bouldin Island was worth and sold for $300. per acre. Today the Island could probably be bought for $50 to $75 per acre.

No single reclamation district can hope to do more than reasonably safeguard themselves; they cannot control the problem nor guarantee immunity. While the flood of March 1907 stands as the greatest recorded, there is by no means any certainty but what greater have preceded and may follow.

ENGINEERS REPORTS

Because of the uncertainty and because of the vast amount at stake, persistent efforts have been made for years to develop a practical plan to control the situation as a whole. Reports have been made at various times by Col. Heuer, U.S.A., Wm.H. Hall, State Engineer, Marsden Mason, and C. E. Grunsky, dealing with the problem.

DABNEY REPORT

A State River Convention was called in San Francisco in 1904, the result of which was the appointment of a Commission consisting of: Major Dabney, Chief Engineer of the Yazoo Mississippi Delta Levee District, Major Richardson, Member U. S. Mississippi River Commission, Major Chitendon in charge of Yellowstone Park and Missouri River and M. A. Nurse, Chief Engineer to the Commissioner of Public Works of California.

The report of the Commission is known as the Dabney Report. It begins as follows:

> "Last spring disastrous flooding of broad areas of the lowlands of the Sacramento and San Joaquin valleys, embracing several of the best reclamation districts of our State, upon which vast sums of money had been expended for protection and drainage, again forcibly demonstrates the insecurity of reclamation interests under existing river conditions and disconnected efforts toward flood control."

> "The plan submitted by the Commission provides for channel rectification and enlargement and gradual concentration of the flood volume between lines of levees so located as to ultimately provide ample area for transporting all the flood volume."

Since the publishing of the Dabney report numerous Government gauging stations have been established. The Commission had but meager data as to maximum volume to be dealt with, and assumed from what data were available that a maximum of 350,000 second feet would amply cover any contingency that might arise.

To carry the volume from Collinsville to Cache Slough, the channel section between levees was estimated at 33 feet deep and 1400 feet wide. This would, of course, decrease going up stream as tributaries of the main river were passed.

The total cost was estimated at $24,000,000, but land values at $300,000,000 would be added to the State's resources.

Because of conflicts between the Federal and State Governments, no headway was made looking to the carrying out of the plan during the next three years. In 1907 the great flood came, and in place of a maximum of 250,000 second-feet it was found that a maximum of 650,000 second-feet had to be provided for.

An amended report by the California Debris Commission was published in 1911. The plan recommended is based on a maximum volume of 700,000 second-feet of water, and the estimated cost is $33,000,000.

Subsequently the State created the Reclamation Board which must now approve the plans for all reclamation work; and it is insisting that all projects conform closely to the general plan of the California Debris Commission outlined in the amended report just mentioned.

PRESENT CONDITIONS

Some work at the mouth of Suisun Bay has been undertaken that will afford a measure of relief, but no permanent and absolute cure can be expected or hoped for until the entire scheme is carried out; in which event the delta lands and the swamp and overflow lands of the Sacramento Valley will become quite as fertile and famous as the famed Valley of the Nile. It must be remembered that all of this land is included in the 2,500,000 acres comprising the Sacramento Valley so that there are in reality two problems; one, the irrigation of the lands above the flood plane; the other, the reclamation of the low-lands. The Natomas Consolidated have practically completed the reclamation of American Basin, some 70,000 acres, and two other projects well under way will reclaim about 90,000 acres more in Sutter and Yolo Basins, while many other smaller projects are in varying stages of development.

It is a serious question as to the liability of a reclamation district in thus diverting water onto adjoining lands. A recent decision in Stockton has awarded damages amounting to some $4,000. against a reclamation district for flooding the property of an adjoining owner because of a levee built by the district. Added to this is the certainty that a

partial reclamation only accentuates the trouble, although the Natomas and other very large projects evidently believe that their levees will be so strong that the other man's levee will go first.

PURCHASE OF OVERFLOW LANDS

Personally, the writers would not advocate any large investments in reclamation projects, although believing that the purchase of overflow land will in the next ten years show splendid profit by simply sitting still and waiting. The purchase of such properties as Bouldin, Jersey, or Ryer Island cannot possibly fail of large profit in the end. How long it will be before the general plan of reclamation is carried out is hard to say. Many difficulties stand in the way one of which is divided control between the United States Government on the one hand and the State of California on the other.

COMPLETION OF THE PROJECT

That complete reclamation will eventually be accomplished goes without saying as the benefits are so obvious and of such magnitude that the work must be undertaken as a public necessity. The first step has been taken in the channel rectification at the entrance to Suisun Bay, provided by the State of California and the United States Government jointly is being spent by the United States Engineers. Other

steps will follow in due course and eventually the project as a whole will be an accomplished fact.

CHAPTER VII.

PLAN OF DEVELOPMENT

OPINION OF EXPERTS

It is the unanimous opinion of the experts consulted in the preparation of this report that the absolutely safe method of reaping the greatest profit from irrigated farming in California comprises the acquiring of the land and water in one ownership; applying the water and improving the land; selling only when satisfactory prices are attainable even if a delay of years be necessary; and relying in the meantime upon the product of the soil to supply not only interest on the investment but an additional income that may quite possibly bring the total annual return up to 12, 15 or even 20 per cent per annum on the original capital.

NECESSITY FOR LARGE CAPITAL

It is not possible to successfully undertake any irrigation development project in California without command of very large capital. One of the vital factors necessary to success is thus stated by Mead in his work "Irrigation Institutions":

> "No adequate system of irrigation, or any enduring prosperity for the people who till the soil, can be built on separate ownership and divided control of land and water."

Because of the capital necessary to develop an ir-

rigation system or reclaim overflow areas, it is necessary to control a large acreage of land in order that the cost may be within commercial limitations. It is also necessary that this work be done with the greatest rapidity possible, owing to the interest charge that will be accumulating from day to day.

It may be laid down as axiomatic that it is necessary to complete the development in the shortest space of time. The larger the project the more vital becomes the necessity of rapid work. The present value of $1.00 deferred one year at 6 per cent is 94.34¢, two years it is 88.99¢, five years 74.72¢, ten years 55.83¢ and twenty years 31.18¢. The desirability of development in the shortest possible time is therefore simply a matter of mathematical demonstration. Failure to recognize this principle has resulted in disaster to numerous large enterprises wherein working capital has not been provided with sufficient rapidity.

RATE REGULATION OF WATER COMPANIES

In California all companies and even individuals supplying water for irrigation are public service agents and subject to exactly the same rate regulations as is water, gas and electricity supplied to cities; the only restriction of the power of the State Railroad Commission being that they may not fix a rate which will return less than

6 per cent nor more than 10 per cent on the investment. All this may be obviated by owning both water and land and selling the land with a share in the water so that the purchaser takes the land and a definite interest in a mutual water company and thereafter pays his share of water expense.

IMPOSSIBILITY OF GUARANTEEING PURCHASERS

Provided this land can be farmed immediately on completion of the ditches, the time elapsing during which no interest is being earned on the investment will be relatively short. If on the other hand, however, the large investment is made on the faith that the public will promptly buy, it follows that sales must be made immediately or interest charges will pile up at an appalling rate. The land and the water can be guaranteed; the costs of joining them definitely calculated; but no one can promise with certainty that the buyers will be forthcoming. Herein is the weak link in the chain, and in order to make the project complete without possibility of failure it is necessary to plan and carry out the farming of a large part, if not all, of the land purchased.

LARGE FARMS IN CALIFORNIA

There is nothing revolutionary in such a proposal. In California the Kern County Land Company has over 70,000 acres in alfalfa, and has one field

embracing over 12,000 acres. James Irvine farms over 70,000 acres in Southern California and there are numerous vineyards and orchards of thousands of acres.

On the west side of the Sacramento Valley one company is now planting an orange and lemon orchard of 10,000 acres, for which water is being pumped over 276 feet vertically out of an irrigating canal.

ADDED PROFITS AND DEVELOPMENT

Astute selling agents are a unit in insisting that for every dollar so invested in improving land by cultivation, two dollars will come back when the land is sold. The question to be answered, of course is: Can the great farm be made to pay? Properly managed, with careful selection of crops to be produced, there seems to be no dissenting opinion among those best able to judge. It is contended that the application of methods that have made the great corporations successful can be applied to farming; and results achieved that will be little short of marvelous.

THE FARM AS AN INDUSTRIAL PLANT

Consider the farm as an industrial plant. In California, with its soil and irrigation, the output will be as great centuries hence as today. The demand for the product must constantly increase, and obviously prices must, in the long run, advance. The area of irrigable land in the West is limited. Mead

states it thus:

> "If every drop of water which falls on the mountain summits could be utilized, it is not likely that more than 10% of the total area of the arid West could be irrigated, and it is certain that because of physical obstacles it will never be possible to get water to even this small percentage."

Irrigable land is not, therefore, unlimited in quantity, and it is not necessary to fear competition from unexpected sources. Properly handled, the proposal is free from governmental attack. From its very nature the agricultural industry must enjoy the maximum degree of freedom from the restrictions under which the great corporations have been laboring.

The plant hazard is nil.

The plant obsolescence is nil.

The plant deterioration is very small and can be almost wholly obviated by proper crop rotation alone. The other part of the fixed plant, ditches, dams, etc., have very small deterioration. The buildings, farm equipment, etc., constitute a small percentage of the total investment, and they, with proper attention and management, will have as a whole less depreciation, maintenance and renewal charges than the rolling stock of railways.

The prevailing rate of taxes is a little high because land cannot be concealed and the "list price of the stock" is the only basis of valuation which can even be suggested to the assessor.

With a given plant the cost of production and the output depends upon the management. By and large on the average the farm is far and away the worst managed industrial plant in America. With essentially identical plants, and the output and the unit costs sanely figured, the balance sheet totals touch every degree from heavy deficits to startling profits. The general average is so far below the best results authentically reported as to make the former appear absolutely absurd.

A little thought explains this. In the cities the inefficient gravitate into the ranks of some branch of the industrial army and are directed, superintended, disciplined, forced into rigid routine, and constrained. In the country they are independent, reporting to no one, receiving no orders and few suggestions; following their own inclinations and judgments, except as they may be led thereby into such hopeless disaster as to lose their plants and be cast into the wage earning class. The wonder really is not at the wide range of results, but rather that so large a proportion are able to keep their plants at all. It speaks volumes as to the profitable nature of the industry itself.

COST DATA

It is, therefore, worth stopping to realize that an industry having in the State of California

alone an annual raw output exceeding a third of a billion dollars is on the whole as innocent of accurate records as is the untutored savage when constructing a wigwam. Such a state of things was disclosed in collecting the material for this report. It has been most difficult to secure any really valuable cost data covering output and cost over a series of years. Relatively speaking, as compared to the available cost sheets of large corporations, similar data applying to farms are, except those kept by a very few individuals, non-existent. The nearest approach to reliable cost and output data extant are, with such exceptions, figures for but one or two years and rarely accompanied by explanations as to the bases or manner of compilation. Viewed in the light of modern cost keeping, such data is of little value in determining actual balance sheets to be expected.

The output and production costs for any given area and crops must therefore be constructed by experts of State and National agricultural departments. Some of these men have excellent judgment and have traversed every portion of the State time and time again in their work and are thus peculiarly qualified. From them have been obtained all basic data, such as men and team days, maintenance and deterioration of equipment, water required, operations,

marketing costs, crop yields, etc., and from past market reports, market prices obtained and hence to be expected. From these, gross receipts and operating expenses were built up and checked, and the figures as given in Chapter VIII, "Farm Management", are believed to be conservative in every detail. With but few exceptions the net returns are much lower than any corresponding published results.

There are numerous examples, the reliability regarding which is quite beyond question, of results many times better, some of these being tabulated in Chapter VIII, (See table No. 40.) "Farm Management", and are given only as examples of what some people claim to have accomplished. It is possible that such figures constitute a standard which is not unattainable in continued practice, but in the light of present information it would be more than unwise to expect reaching it. With results a fraction so good, the real value of irrigated land in California based on the net returns would be very far in excess of the present selling values.

DIVERSITY OF PRODUCTS, EFFICIENCY AND OPPORTUNITY

To accomplish these results it will be necessary to adapt the crops to be planted to the soil; keep accurate cost records; and, in short, conduct the farm, whether it be 1,000 or 100,000 acres, on the same basis as any large, modern manufacturing

enterprise.

If cattle, hogs and poultry are raised, cold storage must be provided to the end that products may be marketed at advantageous periods. If dairying is included, plans for carrying and marketing butter, cheese, milk and cream must be rigidly carried out. If vegetables and fruit are included, a canning plant must be considered, as well as storage facilities for potatoes, onions, nuts, etc.

Efficiency in buying, producing and marketing must be the foundation of the enterprise. This, coupled with the ownership of suitable land and abundant water, cannot fail of complete success. Whether such a unit should eventually be cut into small farms and sold is for time to say. It is the personal belief of the writers that stock in such an enterprise would come to be considered as equal in security with the best class of railway bonds, while having an interest return at least double.

The opportunity for several such farms exists in the Sacramento Valley. Year by year, however, it is becoming more and more difficult to control both land and water in large quantities, and the day is not far distant when it will have become an impossibility. The tremendous amount of capital required considered in the light of agricultural operations to date has entirely prevented the develop-

ment of any but the very small projects along right lines. Being hopeless of doing things right, the alternative of doing the little which is possible results in enough development to spoil many opportunities and yet so unsatisfactory as to cause litigation, slow progress, excessive costs, and to put far into the future the highest development which must unquestionably some day and in some way be the final result.

Such a farm among its crops might readily comprise oranges, olives, potatoes, walnuts, almonds, sweet potatoes, beans, sugar beets, barley, corn, alfalfa, tomatoes, celery, live stock - cattle, hogs and poultry, and the products of the dairy,as well as a packing and cold storage plant, and possibly a sugar refinery.

It is believed that the conservative plan of operation would be to purchase a tract or tracts of land that comprise both citrus, deciduous and alfalfa land, the former being the land on the fringe of the valley; the first gentle slopes as the country rises towards the mountains, and the latter being the river bottom or overflow lands.

The method of operation then would be to plant the alfalfa land, raise cattle, hogs, and perhaps maintain a dairy as an adjunct. From the profits of this enterprise pay 6 per cent on the

investment and use the remainder to plant and care for the orchards to be planted. Eventually, if it is determined that the orchards would be more profitable than alfalfa, beets, beans, etc., the land can by degrees be changed from these to fruits.

To do this the amount of capital lying dormant will be reduced to a minimum, as curiously enough the citrus land that in the long run is expected to yield the greatest return is today the cheapest in price. The reason for this is that the development requires relatively large capital and longer time waiting returns than the putting in of alfalfa, which may return a good portion of the cost of improvements the first year and so immediately raise the selling value of the land involved.

It is possible that it might be found desirable to plant a large part of the acreage of alfalfa and rent a portion or even all of the land instead of handling it direct. Alfalfa lands are generally rented to dairymen, the usual terms being from $15.00 to $18.00 per acre per annum for lands within four miles of a railway station. There are numerous leases in the Modesto and Turlock Irrigation Districts ranging from one to ten years duration wherein the rental is paid in advance at such prices. A few such

leases are given in the table page 123, in the next Chapter. Obviously those operating such leased lands must and do make money therefrom. Hence the total net returns from alfalfa handled as planned are thus shown to check well with the figures deduced.

GREATEST RETURN ON INVESTMENT

The plan now being generally followed in the Sacramento and San Joaquin Valleys is to buy tracts of land on long time, develop a more or less satisfactory supply of water, usually as cheaply as possible, subdivide into small units, and start a selling campaign. The basic idea is a "quick turn" disposing of the land, for sale contracts, with a small cash payment down and a series of deferred payments, and as rapidly as possible putting the sale contracts in the shape of mortgages which can be disposed of to the savings banks and private individuals throughout the state. The first in the field - a very few years since - made tremendous profits on the small amount invested. This started the movement which quickly grew in geometrical ratio until there are over a million acres in the Sacramento and San Joaquin Valleys on the market in 20 and 40-acre tracts, at an average price of about $200. per acre.

The purchasers of these lands must spend an average of at least $20 per acre to prepare and plant; $70. per acre for fences, buildings, equipment, stock, etc., (see next heading) and something for living

expenses until crops can be raised and sold. Buying the land on long time makes it impossible to give a mortgage on it. With an initial payment on the land of $20 per acre, the capital required by the average small buyer can hardly be less than $125. per acre. Undoubtedly many men will succeed with the venture on much less, and on the other hand many will fail with much more. Nevertheless, the average cash capital requirement must be at least $125. 1,000,000 x $125 = $125,000,000 as the sum necessary to be brought into the state to absorb such acreage. Because of smaller towns developing under conditions which will ensue, and other factors, probably $250,000,000 would be nearer the truth. At any rate, the amount is tremendous. Indeed, few people seem to realize the tremendous task of transforming 1,000,000 acres of grain and overflow land into small intensive farms, nor the time element involved. There is about twenty-five per cent of this acreage irrigated in all of Southern California south of the Tehachapi, exclusive of the Imperial Valley. Southern California's development, though unprecedently rapid, has required the best part of half a century.

The wonderful natural resources of California's Central Valley will ultimately justify such colonization, but in general the method in vogue does not afford an opportunity for <u>investment</u>, but instead,

speculation, in land margins.

Operating on conservative lines, that is, making an investment, with ample capital, the greatest returns will be realized by buying lands for cash, thus getting much lower prices, and bringing all those lands to the highest state of productivity in the minimum possibile time. In this way "interest during construction" is reduced to the lowest figure. This method of proceeding brings in the Farm Labor problem and the Farm Marketing problem. On the other hand, it eliminates the Colonization and Selling problems entirely.

FARM LABOR AND MARKETING PRODUCTION PROBLEMS

Practically all the real difficulties the Reclamation Service has found in making homes in the arid West have their root in the "human factor". The land with as nearly perfect irrigation systems as can be devised is taken by earnest "home builders" from every quarter of the nation. These people have no homogeneity, no neighborhood leaders or traditions, no local experience in agricultural methods, crops or markets - everything is new. It is inevitable that many settlers must expend much money and labor most inadvisedly. It is just as much and just as disagreeable pioneering even though of a different kind, as in the frontier days. Most people who understand the conditions and who have enough money

to insure success are not attracted. The statistics of the Reclamation Service show that the average man who seeks farms in the Reclamation Service projects has less than $1,000 capital and only a small percentage has more than $3,000; and the latter figure is too small for a family to make a home except with severest privation.

Both the labor and the marketing problems can apparently be avoided by leasing lands in small areas. To do this however in a satisfactory manner necessitates leveling and preparing the land and bringing it into a fair state of subjugation. Such a course however is only transferring to others the difficulties that must be solved and by others illy able financially and probably mentally to combat them.

Furthermore, it may almost be said that efficient farm help can not be found in the West; intensive farming means a large amount of labor per acre; and the irrigation farmer must practice intensive farming to make good, especially on $300 an acre land. This all forces toward small irrigated farms - almost one man farms. Renting in small tracts to reliable, responsible farmers is impracticable, because such men prefer working for themselves and making permanent homes for their families.

The true solution follows from the following facts:

1. Many people with very little capital and experience in irrigated farming are really obsessed with the desire to own and live on a California orchard and vineyard, or small farm.

2. Some of these live in crowded American cities and towns, some on American farms, and some in Germany, Italy and Portugal. The first two classes particularly would be affected greatly by pioneering hardships. The third class would probably have to be, for a period at least, guided and directed in the methods applicable to California conditions and given considerable advice for several years after coming to California.

3. Few of all these people could even consider buying land or would be sufficiently responsible or trained in the business to justify leasing to them.

4. All would gladly pay considerably in excess of the market price, everything considered, for a farm in complete cultivation, all pioneer work done - civic centers, marketing agencies, social life, etc. - and make the first payment by a proportion regularly held out of their wages over a period of several years. During this period they would also be being trained in the business, and the good sifted out from the useless and indifferent.

5. In farming, as in other lines, there is a marked tendency for men to do as their neighbors, resulting in local overproduction of one crop this

upon supply and demand, and a central czar-like corporation, strong financially, could steer a far more profitable course than a lot of unorganized, or even wonderfully well organized, farmers in the matter of crop selection and marketing, just as well as in construction, buying, etc., etc.

PLAN RECOMMENDED

The conclusion follows that the best plan is to buy the land; put water on it; build all roads, civic centers, packing houses, etc.; establish an efficient marketing organization; attract and hold the best class of labor by a combination bonus-reserve system; farm all the land as quickly and intensively as possible without necessitating a too great "peak labor load"; as bonus-reserves held by the company for the laborers become large enough to justify, lease small acreages to each good man building a house, barn, fences, etc., and furnishing stock and equipment; and have such leases contain option for purchase on easy terms.

Such procedure would have several distinct advantages. It would provide a selected lot of settlers, which, together with the subconscious control afforded over the men, would practically entirely prevent failures on the tract. This is a feature of vital importance. Next, it would insure

high prices for lands sold, and entirely eliminate the selling costs. These latter now average more than 25 per cent of the selling price of land. It would do away with all the hardships of "pioneering", and result in producing model communities - physical and sociological - quickly, with little or no economic waste. By buying additional land from time to time to replace that sold, the Syndicate Farm would continue as long as desired, and at the same time be generally regarded as an effective "back to the land"- almost philanthropic - agency as much as a Syndicate.

As a matter of fact, such a work would be not only profitable but of tremendous value to the commonwealth and would result in a great service to the State.

CHAPTER VIII.

ECONOMICAL FARM MANAGEMENT COSTS AND RETURNS

PRESENT STATUS

The various Agricultural Colleges in the several states and the United States Government through the Department of Agriculture, working in part independently and in part cooperatively, have acquired and disseminated an immense amount of information regarding agricultural science. In the acquisition of scientific knowledge and methods, agriculture has kept pace with, if not gone ahead of, work in other technical lines. Nevertheless, so-called scientific farming has as yet made little impression on California farms, because educational and scientific research institutions can no more train men for farm management than similar institutions in other technical lines can train men for managing mining properties, railroads, electric power and lighting companies, etc. Technical graduates in other lines go from the educational institutions into operating companies, and by these are taught to apply and bring down to a commercial, practical, managerial basis the scientific information imparted in the schools. Efficiency is the keynote of the argument; the utilization of by-products; producing, transporting, manufacturing and selling; exactly as the Standard Oil

Company has done, and making, as it has made, the combined profit in place of the single profit.

The following estimates of maintenance and operating expenses, and of gross receipts for a large farm in the Sacramento Valley have been built up by the careful investigation and adjustment of information obtained from a great number of diverse sources, and on as near as possible actual pre war costs. In making those estimates all labor and team costs have been reduced to a basis of 8 actual hours per day on the work, whereas the usual time at present is almost universally 10 hours. Wages have been taken at $2. per day per man, and $3.35 per day per team equipped with harness and necessary machinery. Thus one man and two horses with harness and plow or rake or harrow or other agricultural implement is taken at $4.25 per day; 1 man and 4 horses at $6.50 per day; and 1 man and 6 horses at $8.75 per day. The prices quoted are those at which 9 hours per day work in considerable quantities can under normal conditions be hired done on a force account basis through the entire Valley, the contractor to furnish and keep men, stock and farming equipment and assume all chances of delays account of bad weather, etc. Obviously such contractors make a fair profit, and therefore these figures must be amply safe.

The yearly charge for irrigation water has

been taken at $3.00 per acre. Taxes have been assumed as 2 per cent on a valuation of $75.00 per acre. Assessments generally are made on a basis of 60 per cent of the selling value of farm property. Overhead charges are taken at 15 per cent of the operating costs exclusive of water rental, because the water rental of $3.00 per acre per annum on half the gross average will yield a fair profit on the operation of the water supply system as such. The maintenance and deterioration on farm structures is taken at 10 per cent.

The gross returns from crops are on the basis of average yearly prices. The value of farm products varies considerably throughout the year, due in large measure to the farmers being forced to borrow money on their crops and consequently to sell the same immediately after harvesting. It is assumed in this project that the company will be financially able to sell its output solely with the idea of obtaining the greatest net return. The estimates presuppose the land to have been properly leveled, bordered, or provided with furrows in case of furrow irrigation, and that all checks, delivery boxes, drainage gates, etc., have been installed in the best possible manner to the end that the cost of operation and maintenance will be a minimum, and that the water supply will be thoroughly satisfactory for the very best irrigation

practice.

ALFALFA

Alfalfa has been grown for more than 3,000 years. Experience shows it thrives best in the soil and climate of semi-arid and arid regions. The abundant sunshine, the warmth and the deep rich soil [illegible] prevailing throughout the irrigable portion of the Sacramento Valley seem ideally suited to its requirements. It is difficult to overestimate the importance of this crop to western farmers, because the yields are exceptionally high when irrigation, favorable climatic conditions, and proper treatment are combined, frequently 9 tons in 5 cuttings being harvested in California. This large tonnage together with its high feeding value and the fact that it is consumed by practically all farm animals, makes it not only a convenient and useful crop to the grower, but a highly profitable one as well. In addition, it cannot be excelled as a preparatory crop on soils the productiveness of which has been impaired by continuous grain cultivation, and it likewise maintains the fertility of soils naturally rich in plant food so that if used as a base of rotation it makes possible very abundant crop yields of various kinds. In Bulletin 110, Experiment Station of the University of Colorado, a statement is made that the fertilizing value of the stubble and roots of mature

alfalfa plants is approximately $35.00 per acre when measured by the commercial value of artificial fertilizers on the market. In spite of its present importance and great value in irrigation farming, the profits in alfalfa production can be greatly increased if more skill and care are exercised, because generally speaking the western irrigator has seldom been able, financially, to dig his ditches and prepare his fields in such a way as to insure the most efficient irrigation and the highest returns.

Alfalfa is planted in the Sacramento Valley in Spring, and about 12 months later is ready to have its first crop taken, and thereafter, produces regularly for from 8 to 20 years, depending upon the character of the soil, without any diminution of output, if properly handled.

Cost of Production

The handling and cost of each operation in alfalfa production are:

(Table No. 33.)

First Year	Per Acre
Plow in March, 1 man and 6 horses plow 5 acres per day, $8.75 ÷ 5	$ 1.75
Harrowing in March, 1 man and 6 horses 12 acres per day, $8.75 ÷ 12	.73
Clod smashing in March, 1 man and 6 horses smash 10 acres per day, $8.75 ÷ 10. .	.87
Seed, 15 lbs. per acre @ 20¢ per lb. .	3.00
Drilling, April 1-10, 1 man and 2 horses drill 10 acres per day, $4.50 ÷ 10 .	.45
Clod smashing, April 1-15.	.88
1st Irrigation, 2 men can irrigate 20 acres per day, $4 ÷ 20.	.20
Carried forward	7.88

(Table No. 33. Cont'd)

Brought Forward		7.88
Light Harrowing, May 5-20, 1 man and 4 horses can harrow 12 acres per day, $6.50 ÷ 12.		.54
2nd Irrigation.		.20
3rd Irrigation.		.20
Cut with mowers, Aug. 1-15, 1 man and 2 horses can cut 10 acres in a day, $4.25 ÷ 10.		.43
(This cutting not worth raking		
4th Irrigation.		.20
Annual Water rental		3.00
Total expense of Farm Operation		$12.65
Taxes, 2 per cent on valuation of $75.	$1.30	
Overhead charges, 15% on $9.65. .	1.45	
Maintenance and deterioration on farm structures, 10% on $12.50.	1.25	4.20
Total Cost first year		$16.85

(Table No. 34.)

Second Year:

	Per Acre	
Amount forward from first year		$16.85
Cut with mower, April 20 to 20	$ .42	
Rake, April 21 to May 21, 1 man and 2 horses can rake 20 acres per day, $4.33 ÷ 30.	.22	
Cocking, 1 man can cock from windrow 10 tons per day and 1-1/2 tons per acre, $2. ÷ 10 x 1-1/2	.30	
Hauling off, Apr. 23 to May 25, 8 men and 9 horses can haul and store 25 tons per day $38.13 ÷ 35x 1-1/2. .	1.56	
First irrigation, Apr. 28 to May 28. . .	.05	
Second Harvesting, June 20 to Aug. 1 . .	2.50	
Third irrigation and harvesting.	2.55	
Fourth " " "	2.55	
Fifth " " "	2.55	
Sixth " " "	2.55	
Annual water rental.	3.00	
Total cost of second year farm operations	$18.25	
Taxes, 2% on $75.	1.50	
Overhead charges, 13% on $15.25.	2.30	
Maintenance and deterioration farm structures.	1.25	23.30
Total cost first and second year		$ 50.15
Value of crop second year.		49.00
Net return		$ 1.15
Cost per annum thereafter.		23.30
Value of crop.		49.00
Net return per annum.		$ 25.70

Life of field estimated at 10 years when it should be replanted.

This figure, $20 to $21 net returns per acre per annum on alfalfa, are rather shown to be conservative, by the actual rental price for alfalfa throughout the State generally, and this region in particular. In Imperial Valley, where money is still on an 8 and 10 per cent basis, many alfalfa ranches with practically no other improvements are renting for $15 to $18 per acre per year. Much of this land is used for dairying. In the Turlock and Modesto Irrigation Districts much alfalfa is rented also for dairying. Two concrete instances of many are given.

Mr. C. L. Jones of Modesto rented 296 acres in alfalfa situation 4 miles east of Modesto for a period of 10 years for $35,000 cash, paid when the lease was signed. This is equivalent - algebraically calculated to - $16. per acre per annum, taking interest at 6 per cent.

Mr. John Crow, Director of the Bank of Newman, leased 196 acres 2 1/2 miles from Crow's Landing on the Southern Pacific Railroad 7 miles north of Newman for a period of five years for $4,000 per annum, cash payable in advance. This is at the rate of $20.41 per acre. This tract has very inexpensive improvements. The lessee is a Portuguese and used the land for dairying.

Many owners prefer to lease on the shares, claiming to receive more that way, on the average in

that region $25 per acre.

ALFALFA MEAL MILLS

Concerning the value of loose alfalfa hay, it is to be noted that several alfalfa meal mills have made ten-year contracts with farmers in the vicinity for the entire outputs of hay at $7.00 per ton delivered at the mills. These mills obviously operate at a profit and cost but about $13,000 to $15,000 for daily outputs of 35 tons. It would, therefore, doubtless be desirable to erect and operate one or more such plants.

Alfalfa meal mills grind alfalfa into a meal which is sacked and either fed to stock in that form or made into stock food. The loss in producing alfalfa meal from alfalfa hay is less than one per cent by weight.

Alfalfa meal is now quoted at $17.50 a ton f.o.b. San Francisco, at which price the mills make $1.25 profit over and above all expenses with hay figured at $10.00 per ton.

Alfalfa meal is also mixed about 85% alfalfa meal, 10% low grade molasses and 5% distillery grain, etc., the proportions being slightly varied, into horse food, cattle food, poultry food, etc. There are probably a dozen alfalfa meal mills in California and two mills near San Francisco which manufacture alfalfa meal into various stock and poultry foods.

Alfalfa meal is as standard and permanent a product as wheat flour. The price of hay in the field varies from season to season, depending upon the quantity produced, which in turn depends under present conditions upon the seasonal rainfall. The opportunity for profit in being financially strong enough to hold back alfalfa meal for satisfactory if not the highest prices is obvious.

Plowing, harrowing, clod smashing, drilling etc., can be more cheaply done by the use of oil tractors than with horses, figures on actual results indicate that the cost of plowing will be somewhere between 75¢ and $1.25 per acre, including deterioration, repairs, fuel, operating costs, etc., liberally figured, and it seems certain the latter figure is high. Accordingly the foregoing cost figures are certainly conservative and quite easily attainable on any tracts exceeding 1,000 acres.

BARLEY

Some acreage of a grain crop such as barley is usually put in on a farm to provide grain feed for work stock and to finish off cattle and hogs for market. In the Sacramento Valley a crop of at least 15 sacks per acre can be raised without irrigation. If the land is properly prepared and irrigation used the returns will be some greater, but the land there has been so

continuously devoted to grain culture as to make its productivity therefor low. This land if put in alfalfa for five or six years and then plowed up and planted to barley with irrigation will yield at least 30 sacks per acre.

In the following it is assumed that the land as it stands without preparation and without the use of any irrigating water will be planted to Barley in March, the crop harvested in July, and the stubble then pastured by stock.

(Table No. 35.)

Cost of Grain Production

The handling and cost of each operation are as follows:

Plowing	$1.75
Drilling seed, March 10 to April 10	.45
Seed for sowing, 100 lbs. $1.50	1.50
Harvesting with combined harvester, 4 men and 22 horses can harvest 20 acres per day, $32.75 ÷ 20.	1.64
Sacks, 15 @ 7¢	1.05
Haul off, July 10 to 30, 1 man and 6 horses can haul 400 sacks a day, $8.75 x 15 ÷ 400.	.33
	$6.72
Water rental.	3.00
	$9.72
Overhead charges on $6.75 @ 15%	1.00
Maintenance and deterioration on farm structures 10% on $13.50.	1.25
Taxes, 2% on valuation of $75.	1.50
Total.	$13.48

Returns

15 sacks of 112 lbs. is 1680 lbs. @ $1.10 per 100 lbs.	$18.48
Pasturing value of stubble	1.00
	$19.48
Net Return	$ 6.00
If water rental is not charged	3.00
Net Return.	$ 9.00

CORN

Agricultural experts agree that corn can be as successfully cultivated in California as in the Middle West corn producing states, but only with the use of irrigation water in the latter part of the Summer and early Fall.

It is believed that the production of corn on a commercial scale should be experimented with, and there seems no reason why it should not be a profitable and staple crop of great importance in finishing hogs and cattle for the market.

LIVE STOCK

The most profitable disposition of alfalfa and grain is to have the same utilized upon the property through the raising of hogs, cattle, mules, etc. The pasturing of alfalfa, except for very short periods of time, causes a deterioration in the stand. In spite of this fact it is the usual thing to pasture alfalfa a part of the year and cut it for hay the balance of the time. By so doing the profitable life of a stand of alfalfa is reduced to 8 or 10 years. Hogs must be pastured a considerable portion of the time, and therefore the raising of hogs rather than other stock is more expensive per ton of alfalfa consumed. There is no need for pasturing cattle, horses or mules, but on the contrary they do better when the alfalfa is brought to them.

One acre of alfalfa producing 7 tons per annum will feed 8 hogs, 1.2 head of cattle, 1.3 horses and 1.5 mules. Sheep and goats are so cheaply produced in California by ranging on public lands, in the National Forests, or on very cheap mountain grazing lands, that their production on irrigated land is not profitable. To a lesser extent the same thing is true of cattle, although in practically every part of California, other than natural feed must be provided for cattle approximately half the time, or during the six dry months of the year. Dairy stock must obviously be handled exclusively on irrigated land to secure maximum returns.

Horses are not as profitable to raise as mules because slight blemishes reduce the value of an animal so much. They are less hardy and require more care in their raising than mules.

The practical stock raising possibilities, therefore, are limited to hogs, mules, finishing range cattle, and dairying.

HOGS

Broadly speaking, eight hogs, counting the various sizes actually found in hog raising throughout the year, can subsist on an acre of good alfalfa land. Taking the gross returns, given under the heading "ALFALFA" at $49.00 per acre, or $7.00 per ton, this makes the cost of food $6.125 per annum and attendance

$0.75, making a total cost per annum of $6.875 per hog. At the end of twelve months they will average 150 pounds in weight, and have an average selling price at the nearest railroad station of 7¢ per pound gross, or $10.50 per hog. The cost of production is $6.875 per year, leaving a net profit of $3.625 per animal, or 8 times that, or $29.00 per acre, plus $20.68 profit on alfalfa, or $49.68 per acre of alfalfa.

Such results cannot be obtained in practice because sometimes hog cholera and other diseases are to be expected. These troubles can be largely obviated by scientific handling, but assuming no better results than are usual throughout the State at this time, a reduction of 10 per cent would be more than safe. This leaves $44.68 per acre per annum net return. The damage done the alfalfa field by pasturing may amount to $4.00 per annum per acre, making the final net return about $40.70

MULES

One mule can be raised to the best advantage on 2/3 of an acre of alfalfa, or 2/3 of $49.00, or $32.67 per annum per mule. The cost of attendance, shelter, etc., will not exceed $5.00 per year, making a total cost of $37.67 per head per annum. At the end of three years, the animal can be sold for at least $175.00. The 3 years' cost of the animal will be 3 x $37.67 or $113.01. $175.00 - $113.00 is $62.00

for the 3 year period, or $30.67 profit per animal per annum. 20.67 x 1 1/2 is $31.00 per acre per annum, plus $20.68 profit on alfalfa makes $51.68 total profit per acre of alfalfa.

Mules are very hardy and sensible animals, and the losses due to accidents, deterioration, etc., are quite small. Assuming the general average throughout the State, however, as 10 per cent of the profits, there results a net profit of $46.51 per acre of alfalfa used for mule raising per annum.

FINISHING RANGE CATTLE FOR BEEF CATTLE

The best way to utilize alfalfa land in the production of beef cattle is to buy range cattle when the feed on the ranges fails, about September, and carry them for about four months on alfalfa, at which time they can be sold for 1 1/4¢ per pound more on their gross weight than they can be bought for four months earlier. Two tons of hay, or $14.00 will be consumed by each animal, and two men and two horses will feed 150 head of cattle throughout the period. Two men and two horses will cost $6.25 or at the rate of 1.4¢ per day per animal, or $1.68 per animal for the four months period. Thus the total cost of each head of stock will be $15.68.

The grain during this period will be 200 pounds. Range animals average in weight in September

900 pounds. The average price for a number of normal price years has been 4 1/2¢. 900 x .045, or $40.50, from the value at sale time, or 1100 x .0575, or $63.25, leaves a difference of $22.75. The cost of the animal's keep during this period is $15.68, to which must be added (0.81, being four months' interest at 6 per cent on $40.50, or $16.49. The net profit per animal therefore will be $6.26. Each animal will consume 2/7 of the product of an acre of alfalfa, so that, used in this way, alfalfa will mean a profit of $21.91 per annum per acre, plus $20.68 profit on alfalfa, or $42.57 profit per acre of alfalfa.

DAIRYING

As has been pointed out, stock raising on alfalfa cannot successfully compete with grazing methods of growing beef cattle, but dairy herds must obviously be on alfalfa or other forage crops or pasturage all the time. 1.2 cows can be most economically and profitably kept per acre of alfalfa, while one man to 20 cows throughout the entire year will care for and milk them and get the milk to the nearby creamery. Dairy men will cost, including their sustenance, $60 per month. The cost of dairy cattle per annum, therefore, is .833 x $49, or $50.83 per year for feed, and $36 per year for attendance, making a total of $76.83. Each cow will produce throughout the year an average

of 24 pounds of milk daily for 300 days each year, or 7,200 pounds. 3 1/2 per cent of this will be butter fat, or 252 pounds with a value of 30 cents per pound, or $75.60. The balance, separator milk, fed to hogs is worth .3 cent, or 6948 x .003 equals $20.84. Total annual output of such animal, therefore, is $96.44. Subtracting $76.83, there is $19.61 per animal, or 19.61 x 1.2, or $23.53 profit per acre of alfalfa used in dairy stock per annum. The herd will produce sufficient calves to maintain itself, and something in addition. Such increase can be utilized to increase the herd or can be sold. This source of revenue is not herein considered, nor is any consideration given to the sale of certified milk which, relatively speaking, will return a greater profit than in using the produce as above suggested. The total net profits from dairying on good alfalfa land average $40 per acre, and often undoubtedly exceed that amount. (Compare with figures in Chapter X, Table No. 49.)

POULTRY

Turkeys, chicken and guinea hens thrive to the very best advantage by running over alfalfa. They feed almost exclusively on the bugs and flies, and the forage they consume is in considerable measure compensated by the increased produce due to the smaller number of insects upon the plants. They run about the corrals and not only get food therein without

cost, but act as scavengers to no small degree. The care required under such circumstances is easily given in addition to other farm duties of employees unless a relatively large number are grown, in which case the extra costs they entail are almost exclusively due to collecting and packing eggs, crating live fowls, etc., for market. It is not deemed desirable to make any estimates of profits of such side issues, but eggs sell to dealers for an average of 33¢ per dozen throughout the year, and dressed turkeys, chickens and guinea hens at an average of about 18¢ per pound, so that the item as a matter of fact is really of large importance, and most good farmers in this way pay a considerable part or all their household expenses throughout the year.

SUGAR BEETS

While practically all classes of soil from the heavy black adobe to the sandy loam and river silts are suitable for the culture of sugar beets, yet taken all together the best soil for this crop is a clay loam, of good depth, which contains sufficient sand or silt to allow its being worked into a finely divided condition - just such soil as is found in the bottom lands of the Sacramento Valley. The California climate is peculiarly favorable, since the absence of rain at the time of harvesting, permitting beets to mature, is an important factor. Approximately 2/3 of

American beet sugar is produced in the irrigated sections of the West, and the industry's greatest development will doubtless be there. The need of its extension in the United States is shown by the fact that 75 per cent of the sugar consumed in the United States is imported, and the area on which sugar cane can be grown in the country is limited to a comparatively small region bordering upon the Gulf of Mexico.

The first sugar beet factory established in the United States was at Alvarado, California, in 1879, and this plant has been in successful operation ever since, being controlled by the Alameda Sugar Company, of San Francisco. The American Beet Sugar Co., of Oxnard; the Spreckels Company near Salinas are also operating on a large scale. Indeed, these have been forced to annually plant on leased land something over 50,000 acres to supply the demand for sugar beets. From information chiefly obtained from these companies, based upon an experience extending over a number of years, and growing very large acreage, it has been found that the cost of sugar beet culture on irrigated land, exclusive of taxes, interest, and deterioration of farm buildings, fences, etc., is $30.00 per annum. These figures have been checked with the costs arrived at by Dr. E. J. Wickson, Dean of the College of Agriculture of the University of California, and by F. W. Roeding of the U. S. Department of Agriculture, in Farmers'

Bulletin 392, based upon the results obtained from a large number of individual growers. The production under satisfactory conditions is stated by Mr. Roeding to be 17 tons per acre as a conservative average for growers who do good farming, and that yields as high as 36 tons per acre have been observed by him, and that 25 tons are not unusual. The Alameda Sugar Co. normally pays $5.00 per ton for sugar beets on board cars at the nearest station in the Sacramento Valley. 17 tons at $5.00 is $85.00 per acre gross, less $30.00 cost of farm operations, giving a difference of $55.00 per acre profit. Assuming taxes at 2 per cent on $75.00, interest at 6 per cent on $30.00, and deterioration of farm buildings, etc., at $1.25, making a total of $16.25 for these items, the net annual returns become $38.75.

BEANS

Ventura County, California, is world famed for its Lima Beans, the production of which is so profitable as to displace beet growing, the net returns being stated as exceeding $100 per acre. Because of the climatic conditions the Sacramento Valley is better suited to the production of large White, Pink, Bayo and Black-eye Beans. The acreage of these is comparatively small and confined largely to the Delta area. It is believed with irrigation large areas in

the Central Valley as a whole will be found suitable for bean culture.

RICE

Rice growing in the Sacramento Valley has passed the experimental stage and has within the past 4 or 5 years become an established industry. It is safe to say that because "overflow lands" are nearly level, their preparation for irrigation will not exceed an average cost of $15 per acre. In general it may be said that the best soil type for rice is a medium loam containing about 50% of clay and underlaid by a hardpan or clay which will retain water.

Leveling and checking the fields cannot be done as with alfalfa or other irrigated crops, because it is necessary that the water stand on the field at a uniform depth throughout. Consequently, the greatest care is necessary in leveling the land. At the same time, the fields must have such drainage possibilities as will permit removing the water quickly at the proper time, so that checks must be made relatively small with an inlet from the irrigation ditch and an outlet into the drainage ditch from each check. Ordinarily the checks are from 2 to 5 acres in size, the borders being as low as possible and very broad on the bottom so that ordinary harvesting machinery can be used with comparative ease. The seed bed is prepared very much as for ordinary cereals.

For a while the rice grows as a dry land plant, and then changes its habits to a water plant, after which the ground is flooded. The schedule followed near Chico - about 40 miles from Sacramento - is as follows: During April and the early part of May the ground is kept thoroughly wet, then to the latter part of May water held one inch deep, then to the latter part of August gradually increasing up to about five inches in depth. Because of the low humidity in the Sacramento Valley as compared with that in other rice growing sections of the United States, it is necessary to use a much larger amount of water for irrigation. While in Louisiana 4 acre-feet per acre suffices for producing a crop, it seems to require up to 6 or 7 acre-feet in the Sacramento Valley.

Rice is harvested with a self-binder and shocked, being left in the shock until the straw is cured and the grain is hard. Then the kernels are threshed out by ordinary threshing outfits and bagged, the rice being thoroughly dried before sacking.

While it is too early to form any definite conclusions as to what yield may be expected under California conditions with general and large continued croppings, it can be certainly said that the experience to date gives promise of excellent results. There are numerous fields producing as high as 4,000 pounds per

acre and in a few small fields yields as high as 7,000 and even 7500 pounds per acre were recorded. The average is about 3,000 pounds which has a value to the grower of 2 cents or $60.

The total amount of plant food removed per acre by rice culture, and the distribution of the soil draft between the plant food elements is about the same as wheat culture. Continued rice cropping soon develops an undesirable water logged soil condition, so that there is great necessity for providing for quick and thorough drainage at the close of the irrigating season and the use of drainage furrows to take care of surplus water during winter rains. There is also more than ordinary necessity for crop rotation because of the difficulties which arise from such continued flooding of the lands, and it is necessary to make use of every means of soil aeration to maintain the fertility for many years. Probably it will be found undesirable in California to grow rice on the same land oftener than once in 3 years, rotating with beans, corn, cow peas, etc., in order that nitrogen, on which rice makes an unusually heavy draft, may be replenished in the soil, aside from the mechanized amelioration of the ground. Furthermore, there is considerably more labor required for the growing of rice than of wheat or barley.

Several years ago the United States Department of Agriculture began experiments on the culture of rice in California and this industry has rapidly developed as one of the big new leading crops. In 1910 a few experimental plantings yielded well; in 1912, 1200 acres were planted yielding 3,500,000 pounds. In 1917 it is estimated that the acreage planted to this cereal is over 90,000 acres, - 90 per cent of this in the Sacramento Valley with Glenn County as the general center.

COTTON

Somewhat similar is the remarkable development of Cotton culture almost wholly in Imperial County although Palo Verde and the San Pasqual Valleys along the Colorado River are gaining in importance, and plantings on the bottom lands of the San Joaquin and Sacramento Valleys indicate that this crop may be profitable on much of the irrigated land in the Central Valley.

In the past few years this industry has grown until in 1916 the State produced over 70,000 bales. The average yield per acre is much higher than the average in the South and the quality considerably better.

POTATOES

Excellent qualities of both Irish and sweet potatoes are grown in the Sacramento Valley, the production per acre being extraordinarily large as measured by Eastern and Middle West experience. Inasmuch as these crops require a very large amount of labor per acre as compared with alfalfa growing, stock raising and dairying, so that the results obtained depend to such a large extent upon human labor as well as on soil and climate, it has not been deemed interesting to give in this report figures as to the results obtained from their culture.

GARDEN TRUCK

Some time in the future a great deal of truck gardening will be done upon the land included in any of the projects presented in this report. A great deal of the land behind levees bordering on the Sacramento River today rents for $25.00 cash per acre per annum on long time leases. At present river transportation facilities give such lands an advantage over others in the valley.

ORCHARDS

California orchards are of two classes, those producing citrus fruits and those producing deciduous fruits and nuts. In the foothill fringe of the Sacramento Valley citrus fruits do equally as well

as the famous orange, lemon and grapefruit groves in Southern California; indeed the climatic conditions are such that oranges are ready for shipment a month earlier than in Southern California. This fact will doubtless be something of a shock to most people, who have regarded Southern California as the best locality in the State for citrus fruit growing, but it is well authenticated and established by years of experience. Citrus fruits have not been grown on an extensive scale in the Sacramento Valley because their cultivation requires irrigation. There seems to be no other reason, because a few of the most profitable orchards in the State are located in and around Palermo and Oroville, belonging in the main to the Hearst and Haggin Estates and to W. P. Hammon, the well-known gold dredging man. The disastrous cold snap, a few years ago, which did many millions of dollars worth of damage to the citrus industry of Southern California, caused practically no damage whatever to citrus fruits in the Sacramento Valley. This is due partly to the fruit here having been harvested and shipped weeks before; partly to not so low a temperature occurring; and partly, it is beginning to be believed, to the fact that there is more of a real winter season, during which the trees have no sap running and no new growths starting.

Slight differences in soil and climate have unexpectedly large influence on the development of citrus fruits, but immense quantities of land in the Sacramento Valley are undoubtedly ideally fitted for such culture. Oranges, lemons, olives and grapefruit are usually planted on the low, rolling foothills where the freedom from frost seems greatest.

CITRUS FRUIT ORCHARDS

Land for citrus fruit has, in most parts of the State, started with a valuation of about $50 per acre, and by application of water in satisfactory ways, that is, as to quantity and time, has advanced to about $100 per acre. When some production has been secured and packing and shipping facilities locally provided, the price of the adjacent bare land with water is usually increased to from $200 to $600 per acre.

In a rough way, the best general comparative figures available are those for the gross returns from fruit orchards - good, bad and indifferent - for the entire State as given for 1912 by Dr. E. J. Wickson, of the University of California, in the following table:

(Table No. 36.)

	Acreage	Gross Value Of Product	Acre Average
Citrus Tree Fruits . .	.149,531	$18,163,376	$122.00
Deciduous Tree Fruits.	.314,838	27,820,860	88.00
Nuts	51,413	1,400,000	27.40
Grapes	.281,248	12,500,000	44.50

This includes all acreage reported, both bearing and not yet at bearing age, and also includes everything - good, bad and indifferent orchards - from all parts of the State, some localities of which are not at all adapted to produce the kinds of fruits planted there.

Dr. Wickson explains the low acreage value of nuts as being due to the irregular bearing of the almond account a large acreage being in frosty places, and to the large acreage of walnuts not yet in bearing age. As a matter of fact, a very marked tendency of the American people is toward a decreasing amount of meat and an increasing amount of vegetables and nuts, which has resulted in the price of walnuts and almonds gradually increasing to about 100 per cent.advance during the past 10 years. Indeed, today it is very questionable whether an English walnut grove in full bearing is not more profitable from every point of view and a safer investment than a fully developed orange orchard.

At the same time Prof. Wickson points out that oranges during the past 19 years have been uniformly profitable; that while each of the various deciduous fruits has in some year of large yield and high prices reached about the same extreme of $750.00 per acre, the extreme for oranges has been $1,000.00

per acre gross value of product; and that the average return for orange trees in full bearing is considerably higher than for deciduous fruits.

The actual outlay in bringing orange, lemon, olive and grapefruit orchards to bearing age (for all these fruits are practically alike in this respect) varies considerably with local conditions, but the same authority - Prof. Wickson - who has been intimately connected with the horticulture of the State for the past 25 years, gives the following as a conservative average cost, not including the first cost of the land, interest on the investment or taxes during the period:

(Table No. 37.)

Plowing	$ 4.00
Grading for irrigation	10.00
Flumes, etc., for water distribution	25.00
Trees (average number and price)	75.00
Planting and protection from sunburn	10.00
Cultivating, irrigating, including water, pruning, etc.	
1st year	30.00
2nd year	40.00
3rd year	60.00
4th year	65.00
5th year	70.00

Average Cost for Five Years . . . . . $51.00.

These figures are based upon the same cost of labor and teams as the estimate on the cost of alfalfa production given above. It allows in the first year for re-planting the average number of trees which fail to develop properly, and the later estimates include

the usual outlay for fertilizer and for the average amount of protection required against insects and fungus parasites. It is reasonable to expect 150 boxes of fruit in the fourth and fifth years taken together, but it is conservative practice to consider these as required to offset unexpected cost in protecting trees from diseases, parasites and other contingencies. Prof. Wickson has taken the foregoing from records of actual cases collected during many years of experience in all the sections of the State, the lowest of which records was an average of $30.00 per acre per annum for 5 years, and the highest an average outlay of $55.00 per acre per annum for 5 years. The difference in cost is largely due to variation in outlays required to obtain water, efficiency of management and labor, and different standards of what constitutes good work.

The tables herewith have been carefully compiled in order to determine the cost of oranges and olives, and are believed to be indicative of what may be obtained by careful management.

OLIVES

The cost of an olive grove is practically the same as of an orange grove in spite of the fact that it takes about three years longer, or a total age of eight years, to be satisfactorily productive.

The returns will be from 2 to 3 tons of olives, for which contracts are now being made for five year periods at $90.00 per ton on the trees. That is $180 to $270.00 per acre gross.

DECIDUOUS FRUIT ORCHARDS

There are relatively small variations in the assential cost of different kinds of deciduous fruits, chiefly in the amount of pruning. The cost of trees of standard varieties vary greatly from year to year, because the demand is largely conditional upon prices of different fruits the preceding year, and nurserymen cannot determine the relative number they should grow of each variety quickly enough to meet the demand. In this way trees range from $10.00 to $20.00 per hundred. The consensus of experience in California according to Prof. Wickson is that deciduous fruit trees of early bearing varieties like the peach and apricot can be brought to bear for one-fifth the cost required to bring orange trees to the same stage. In the third and fourth years these early bearing trees often produce a sufficient crop to cover all expenses of the orchard planting theretofore incurred other than the cost of the land. Apple, cherry, pear and plum trees could not be counted upon for such quick returns. On the other hand, the cost of peach and apricot orchards would be somewhat greater in the second and third years because of the labor of pruning and

this increased cost would continue during the bearing period because almonds, apples, cherries, pears and prunes are not pruned back so hard as apricots and peaches require. In irrigating deciduous fruits fewer applications of water are made and the water is distributed in fewer furrows, so that much less preparation of the land for irrigation is required.

The cost of almond orchards at first is much like that of the peach, but after the third year is less than other fruits because of slight pruning which is usually done. The cost of walnut orchards differs from other deciduous orchards in that the high initial cost of the trees, especially when grafted trees are used, is not fully compensated by the smaller number of trees per acre. The walnut orchard, however, being planted at much greater distances between trees - usually 50 feet - and having deep, penetrating roots, allows an intergrowth such as alfalfa without retarding the development of the orchard as is the case with other kinds of trees. On such deep, rich land as walnuts should have, it is possible by means of interculture to bring trees to bearing at no increase in cost over other deciduous trees, though the period before bearing is considerably longer, about 8 years. Prof. Wickson gives the following as an average cost of deciduous orchard production throughout the State:

(Table No. 38.)

	Per Acre
Plowing, harrowing and laying off	$3.50
Planting (In furrow marks)	2.50
Cost of Trees (average 100 per acre)	15.00
Cultivating and Pruning, first year	5.00
" " " second year	8.00
" " " third year	10.00
" " " fourth year	11.00
Total to end of fourth year	$55.00

Thus the investment in an orchard of deciduous fruit at the beginning of the fifth year would be:

Four Years' care	$55.00
Interest on that sum for average of 2 years @ 6 per cent	6.60
Taxes at 2 per cent per annum on $100 valuation with accrued interest at 6 per cent	8.50
	$70.10

To this must be added the original cost of land and water, buildings, fencing, etc., and interest thereon for a period of four years.

The net annual return - gross return less annual cost of operation, including water charges, taxes, etc., but not interest on the investment - will vary from $25.00 to $450.00 with good orchards, and have an average of $40.00 to $60.00 per annum.

VINEYARDS

The cost of young vineyards is quite variable, depending upon the different ways of starting which are chosen by the individual growers. Prof. Wickson states that after very careful examination it has been

found there is very little difference in the cost per acre of bringing deciduous trees and grape vines to a bearing age - that is to say, that with cheap work each costs about the same amount, while with the very best work each may rise to about the same figure. Roughly speaking, a vineyard on its own roots, as in the case of Tokays and Sultaninas, should pay for cultivation during the third year and be profitable the fourth year, whereas vineyards on grafted resistant roots are usually slower in making returns and require increased outlay.

In general, therefore, the investment in a vineyard at the beginning of the fourth year would be about $70., to which must be added the original cost of land and water, buildings, fencings, etc., and the interest thereon for a period of three years.

The net annual return - gross return less annual cost of operation, including water charges, taxes, etc., but not interest on the investment, is generally from $10. to $100. with good vineyards, and have an average of $20. to $25. per annum.

DEFICIENCY IN LOCAL PRODUCE PRODUCTION

California does not yet produce enough butter, cheese, eggs and poultry particularly, for its own consumption. At the request of the writers the Traffic Department of the Southern Pacific Company very kindly compiled the following tables of tonnage moving into

California for the years ending June 30, 1911, June 30, 1912 and June 30, 1913. These figures are the importation by the Southern Pacific Company alone; the quantity brought in by the Santa Fe and the Western Pacific roads would materially increase these figures.

(Table No. 39.)

Commodity:	Year Ending June 30, 1911:	Year Ending June 30, 1912:	Year Ending June 30, 1913:
	t o n s	t o n s	t o n s
Butter	854	117	563
Cheese	957	575	741
Eggs	2121	848	695
Poultry	3250	3013	2396

SOME CALIFORNIA FARM RESULTS

In the way of comparison to the foregoing statement of farming costs and returns, the writers have collected and prepared the following table, consisting of records which have been published of actual results obtained by farmers in the Sacramento Valley.

(Table No. 40)

Person:	Address:	Acreage	Crop:	Yield Per Acre	Average Annual Gross Returns Acre	Average Annual Net Returns Acre	Number of Seasons
1. Mr. A. W. Yerxa	Princeton	10	Alfalfa	12 tons 2nd yr.	$126.	$ 72.	1
2. " " "	"	37	Prunes			315.30	3
3. " " "	"		Dairying			60.00 per hd.(1)	
4. Sherman Stevens	"		"			60.00 "	"
5. G. W. Warfield	"		Tomatoes	30 tons			Several
6. Judge Frank Hill	"		Corn	75 to 100 bu.	56.25		
7. W. F. Bush	"	7½	Small stuff			1,000.00(2)	Several
8. H. H. McAuslan	"	40	Alfalfa and stock Poultry		3,000.00(3)		4th year
9. Mrs. H. H. McAuslan						1,200.00 (4)	Several
10. Mr. J. H. White	Colusa	38	Vineyard	(50 tons raisins(5) (70 tons fresh (grapes	190.00	163.00	1906
11. Mr. J. K. Mills	"	14	Alfalfa	9 tons			3
12. Mr. C. Ronk		10	Dairy and Poultry	275 turkeys	72.50(6)		

1. Not counting calves and seperator milk fed to pigs.
2. In addition to supporting his family of wife and five children. Figures for entire acreage.
3. Besides improving property with orchard, house and other buildings. Figures for entire acreage.
4. Poultry on same 40 acres as in Reference No. 8. Figures for entire acreage.
5. Average production for 11 years.
6. Keeps 16 hens and 1 gobler; also has cows and chickens returns from which he does not give .

(Table No. 40 cont'd)

Person:	Address:	Acreage	Crop	Yield per Acre	Avg. Annual Gross Returns Acre	Avg. Annual Net Returns Acre	Number of Seasons
13. Mr. C. G. Svanson		20	Grapes and Peaches	65 tons grapes	1,300.00(7)		3 years old
14. Mr. Nels Nelson		10	" " "	7.4 " "	150.00(8)		5th year
15. Col. John T. Harrington	Colusa	6	Oranges	370 boxes	1,110.00(9)		Several
16. Mr. C. W. Ilift	"		Alfalfa	8 tons			Regularly
17. " " "	"		Loganberries		800.00		
18. Gibbin Orchard		40	Peaches and Plums		47,348.00(10)		
			Cherries		11,740.00	231.42	5
			Berries		2,000.00		
19. Starr Vineyard	Yuba City		Vineyard	7 tons	77.00	60.00	25
20. Mr. H. T. Heaton		8		14½ tons (dried)	363.33	307.00	1
21. Mr. E. H. Hanly	French Camp		Small Potatoes		300.00 (11)		1
22. Mr. Spencer		18	Alfalfa - Hogs		160.00		1
23. Mr. H. H. Clark	Denair	.3	Dewberries	15,000 lbs.	750.00	487.50	1
24. Mr. M. F. M. Charlton	Hemet	10	Potatoes		200.00		1

7. In addition peaches brought from $.50 to $5.50 per tree. Acreage of each not given. Figures for entire acreage.
8. No figures given on peaches. Expects gross returns 5th year to be $250 per acre.
9. Sells output to Palace Hotel at 50 per cent above ruling prices account quality. Figures not entire acreage
10. Figures for entire orchard for 5 years during which expense including insurance and taxes carefully kept was $15,000.
11. Had the crop in 90 days exceeding cost of land.

A very remarkable acre of land, perhaps the most intensively cultivated in America, belongs to Mr. Samuel C. Cleek, of Colusa, who bought it 30 years ago, put down two wells and windmills to pump water for its irrigation, and put every square foot of it in use. It contains: Cottage and veranda 30 by 30 feet; barn and corral, including two chicken houses, 75 x 75 feet; two windmill towers 16 by 16 feet; garden 46 by 96 feet; strawberries 95 by 90 feet; citrus nursery 90 by 98 feet, containing 400 budded orange trees; row of dewberries along the fence 100 by 2 feet; 4 bearing apricot trees; 3 oak trees; 6 fig trees; 10 locust trees; 1 paradise tree; 4 bearing bread trees; 30 rose bushes; 20 geraniums; 12 lemon trees; 1 lime tree; 8 bearing orange trees; 5 pomegranate trees; 6 beds of violets, 6 by 2 feet each; 1 patch Japanese bamboo; 14 stands of bees;4 huge grapevines; 1 bed calla lilies; 4 prune trees; 6 cypress trees; 1 bed of sage; 1 large garden and flower seed bed; besides honeysuckle and other rare and beautiful plants and shrubs.

This acre has not only supported Mr. and Mrs. Cleek, but it is claimed they have long been able to put aside several hundred dollars yearly.

In this connection Mr. Frank A. Vanderlip, President of the National City Bank of New York City, at a dinner given him by the Clearing House Association

of Sacramento several years ago, said: "This Empire (the Sacramento and San Joaquin Valleys) has barely been scratched, and I do not think you men realize what is ahead of you. I am just completing a trip of 12,000 miles, and in the ride I took this afternoon about Sacramento I have seen the finest illustration of intensive cultivation that it has ever been my fortune to see, and I have ridden over the best roads that are to be found anywhere in the world." Mr. Vanderlip backed these opinions by purchasing the famous Cone Ranch of 18,000 acres at Los Molinos in Tehama County. He also said in his speech that the most tremendous fact and the most tremendous lesson he had learned was the value of an acre of ground; that a man brought up on an eastern farm must reconstruct his idea of farm values when coming to California, as he cannot conceive at first of a soil so productive as to create a value of $200, $300 and even $500 per acre per annum.

APPENDIX NO. I

EXCERPTS FROM REPORT BY PROFESSOR F. H. NEWELL, THEN DIRECTOR OF THE UNITED STATES RECLAMATION SERVICE, OF CONFERENCES HELD IN 1913.

(Italics not in original)

"During 1913 a series of conferences was held to discuss the present condition of irrigation development, the problems of settlement and of utilization of the lands now irrigated. The first of these meetings was with state and railroad immigration agents in Chicago, later with bankers and dealers in irrigation securities, again with state and railroad immigration men in Salt Lake City and then with irrigation managers and others interested in Montana, Idaho, Washington, Oregon and California."

CHICAGO MEETING OF IMMIGRATION MEN

"The results of the conference with immigration or colonization agents held in Chicago on May 31, and June 1, 1913, were printed in the Reclamation Record for June 1913. It was there stated that the present problems confronting those interested in the utilization of reclaimed lands are:

(a) How to find the name and address of the man who really desires a small farm.

(b) How to sift out of the thousands of names thus obtained, those persons who are presumably competent to make a success.

(c) How to gain the confidence of the latter and to make valuable suggestions to them.

(d) How to test the various agencies or individuals who are offering opportunities to determine whether the lands offered are suitable for small farms and homes.

(e) How to get the information concerning these lands to the persons who are seeking them.

(f) How to eliminate the agencies that are known or suspected to be untrustworthy."

"At a later date, namely, on September 18, 1912, an informal discussion was held in Chicago, with men representing various banks or bonding houses concerned with irrigation securities. At that time various phases of the subject were discussed, particularly the question as to how to restore confidence in these securities, and aid in the further development of the arid west. At the meeting the following points were touched upon."

"There are now in the arid west over 40,000,000 acres of land which may be susceptible of reclamation and each acre of which should support at least one individual. In other words, there can be put on land now waste and desolate, within a century, a population of many millions of people. Up to the present time there has been reclaimed by private capital mainly of small investors, by men working with their own hands building structures and ditches, over 10,000,000 acres of land, which is producing a large crop return and supporting a large population."

"About 30 years ago the Federal Government became interested in the more rapid development and utilization of the vacant public lands. An act was passed on June 17, 1902, known as the Reclamation Act which set aside for building irrigation works the proceeds from the disposal of public lands.***With

the amount of money available in this fund, not all the work of irrigation development can be undertaken, probably not more than 10 per cent."******

"The irrigation situation at present is rather difficult. The schemes of private development are at the bottom of one of these waves of depression that come when the public is not well informed as to true conditions. Millions of dollars of stocks and bonds have been issued where the probability of return is very small, and it is now almost impossible to raise money for ligitimate schemes because of the recent heavy losses and disappointments. The conditions are very much as they were 50 or 60 years ago when the railroads were started all over the country. Nearly every one of the railroad companies failed, but out of the ruins were built the present great systems, due to the fact that men acquired experiences by their losses and without being discouraged went at it again with a larger conception of the true conditions."

"So it is with the irrigation development of the West, the opportunity is there, the land is there, the climate is there, and the people are looking for homes."******

"There are to be noted three separate phases of the growth of this subject of reclamation. The first phase was when ignorance prevailed as to reclama-

tion due to the fact that nobody knew much about the engineering or physical features of the problem. Many millions of dollars were invested in past years in total ignorance of the engineering conditions and failure came because of that fact. Then the projectors of new schemes ran up against another rock; that was the neglect of legal matters. The water rights of the various states were not clearly defined or established or safeguarded as are the land titles. Many millions of dollars were invested before it was discovered that many of the water rights were practically worthless. There is now a full realization of first, the engineering and physical conditions; and second of the legal conditions, but the third and most difficult phase of all, the human problem, is not satisfactorily understood and solved. Irrigation works may be built in an ideal place, water rights may be made secure, but after this the real trouble begins; namely, with the farmer who is to use that water and manufacture out of the soil the agricultural crops. The Reclamation Service is now trying to meet and solve this human problem."

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"Now is being demonstrated, by the crop production on the land reclaimed, the conditions to be met in any investment where the money has to be dug out of the soil. This is the point where many of the

private projects have failed and are failing. It is the difficulty of securing the right kind of settlers who will practice a high degree of agriculture and who will study the condition of soil, climate and crop and make a success individually, so that the payments for water can be met when the time arrives."

"By a careful analysis of crop production on recently irrigated land, it is now possible to tell within narrow limits as to what the average man can or will produce. He is not always making a notable success under irrigation. The average crop production is small."

"Delay in getting competent settlers means loss of time, and time means interest; interest doubles the cost of many excellent irrigation schemes. They fail because the promoters could not get the farmers on the ground soon enough."******

"On a reclamation project the settlers can not afford to raise crops to compete with the ordinary crops in the markets of the world. When the country has a small production there is a demand for what can be raised in the vicinity, but when the new comers produce more than can be consumed locally, the price immediately drops."

* * * * *

SALT LAKE CITY MEETING OF IMMIGRATION MEN

"How to get settlers on irrigated lands was the subject of discussion of irrigation commissioners

and agents at an informal meeting held in Salt Lake City, Utah, on September 30, 1912. The meeting was participated in by representatives of various states and railroad immigration men. The "back to the land" movement was considered in various phases and discussions had of the organizations such as the new American Agricultural Society, designed to further an intelligent direction of this movement. The necessity of elementary instruction in agricultural schools was shown."

"It came out that the great part of the lands which have been reclaimed, especially by large companies and by the Government, is not being well irrigated and the average crop production is too small to attract new settlers or enable the best handling of the irrigation projects. This is notable under the Government works, where over 1,200,000 acres have been reclaimed at a cost of $30 to $40 per acre and not much over a half of it is being utilized in the production of crops, although practically all of it is in the hands of homestead entrymen and others. The great difficulty is to induce these land holders to cultivate the soil in an intelligent manner."******

"It is obvious that many of the irrigation projects must be resettled in part by men who have a fair amount of capital and who appreciate that irrigation means hard work and continuous application,

together with intelligent observation and thought. Every irrigator and his family, successfully cultivating a small farm, is worth from $40. to $100. per annum to the railroad."******

"The most powerful influence for drawing desirable settlers to the western states are the letters which are being written by successful farmers and business men to their friends and relatives in other states or abroad."

"The foundation of success, however, rests on the man who is now on the ground and who is making good. Every man who is not making good in a community is not only a detriment to the community directly, but his influence is widespread in preventing development. The work of the "booster" therefore begins at home in getting the unsuccessful man placed elsewhere under more congenial surroundings and in his place securing the successful man whose example is the most powerful influence and argument in boosting the movement."

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BOZEMAN CONFERENCE OF IRRIGATION MANAGERS

"The first of the series of 1913 conferences of operation and maintenance men in charge of large irrigation projects was held at the Agricultural College at Bozeman, Montana, October 17 and 18. There were present several managers of the principal irrigation systems in the northern part of the arid region, the

faculty of the Agricultural College and others interested. The object of these conferences was discussed in bringing together the managers who have immediate care of large irrigation works, those serving water to several hundred or several thousand water users and where on account of size it is necessary to adopt and follow carefully considered rules and regulations."

"The discussions brought out the fact that the present is a time of transition in many parts of the Arid West from the old easy-going way of handling irrigation canals to more effective and systematic modern methods. In cases where the farmers have gradually built the works by their own labor and where each man is well acquainted with his neighbor and with the operation in general, there is possible an easy-going way of distributing water between neighbors, each of whom has learned through years of experience something of his duties and responsibilities. <u>This is not possible in the case of the larger systems built by corporate investment or by the Government, where hundreds of farmers representing the various types of experience, nationality and religion are brought together from all parts of the country."</u>

"The newcomers on these larger projects have not had the advantage of working together; they are not even acquainted with each other's ideas or methods, and through ignorance are often highly prejudiced against

each other, so that there is none of the cooperative spirit which has characterized the building of the earlier irrigation canals.******** Where a half dozen pioneers have joined together in building a small irrigation canal, if mistakes in management were made at first, no very large amount of money or property was involved, and experiments might be made which would be fatal to life and property if undertaken with a large fully constructed canal!"

"It was shown that in the older smaller irrigation systems the individual shareholders have fought or agreed among themselves regarding the distribution of the water until, by constant attrition, they have developed a relatively smooth procedure. They have expended in these controversies and in litigation as a rule more than the canals have cost. Each year the stockholders now meet together, criticise and condemn the present management, elect new directors, and adjourn until the next meeting. These new directors, all of them experienced in past controversies, generally settle back to about the same course of procedure, employ usually the same manager, and continue largely in accordance with unwritten understandings."

"Such easy-going course is impracticable with the large modern works. The water users do not have behind them nearly a generation of experience, and the directors they elect are frequently newcomers,

village lawyers or real estate men, many of whom have not had any considerable experience in irrigation. Hence it results that there must be an entirely distinct method of management and a development of a system which will guard the delivery of water to the individual in spite of the fact that the great body of these individuals, have not had experience in irrigation or even in agriculture."

"The lesson learned in studying the history of the irrigation system is that for success the control in details of all large works must be in the hands of a strong capable manager, having no personal or private interest in the canal, but devoted solely to the carrying out of certain policies designed to secure the greatest good to the greatest number, and at the same time assuring the delivery of water to the owner of the poorest and smallest farm on the project."

"In some cases, despairing of adjusting the warring factions under these systems, recourse is being had to outside corporations organized for the express purpose of making contracts to operate and maintain these irrigation systems in such a way as to be wholly impartial and to guarantee the upkeep of the works and the economical delivery of water. By having as manager a man employed from outside of the area and one who cannot be influenced by local politics, it has been found possible to operate these enterprises with

a minimum of friction and a maximum of efficiency."

"In the case of the modern irrigation systems now being built by private and public capital, it is evident that some such course must be followed, that it is not possible to immediately commit the details of operation and maintenance to the land owners. To do so is to invite on a larger and more disastrous scale the same evils which are rampant in the control of smaller irrigation canals. There must be a strong central organization headed by a manager who is removed from the danger of being influenced by individual water users, and who has enough assistants, responsible directly to him, to enable him to carry out effectively the general plans and policies."

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"At the operation and maintenance conference these conditions were discussed and attention was directed largely to the necessity of the agricultural colleges of the West training young men for the minor positions in canal operation, not especially as engineers, but on the contrary as agriculturalists and irrigators. It appears that the tendency has been to devote the college work too closely to the more attractive side of irrigation construction, the building of dams, canals, power plants, and intricate machinery. What is really needed, however, is a large body of young men brought up on the farm, who have had a thorough education in the theory

and practice of agriculture, in the handling of the soil, and in the application of water. These men are needed to begin at the bottom in irrigation management to fill the places of canal riders, distributing water from day to day to the farmers, covering a length of canal of perhaps 15 or 20 miles, and incidentally to their main work of setting the gates, keeping in touch with the farmer and indirectly giving such advice as may be helpful to the less experienced irrigators."

"In the past these places have been filled largely by local men picked up for the purpose. The very fact that they have been available testifies usually to the fact that they are not successful farmers; otherwise they would be too busy to accept such employment. While it has been necessary to operate systems of considerable size with men obtained in this way, the results testify to the fact that as the large irrigation systems develop there must be provided a body of trained men from whom to select these canal riders, as their position is one of considerable responsibility. Upon them depends primarily the success of the farmer."

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BOISE CONFERENCE OF IRRIGATION MANAGERS

"The second of the 1913 conferences of irrigation managers was held at Boise, Idaho, October 24 and 25. There were present managers of various irrigation systems constructed under the terms of the Carey Act

and of those built by the Government under the terms of the Reclamation Act; also a few representative farmers from the projects and others interested in the management of irrigation canals."

"The discussion related largely to the larger questions of management and to the necessity of having in charge of the work a man of an ability comparable to that of the manager of a railroad system. With canals and distributaries aggregating hundreds of miles in length, the problems of serving water to thousands of farmers is one which demands large experience and a special training as thorough as that of a railroad manager or of a successful man in any profession. It was recognized that while these qualities are demanded, yet public opinion has not yet been educated to a point where compensation can be given comparable to that of the railroad manager; it may be years before a general appreciation is had of the need of well-trained men and of a compensation which will hold these men in their positions."

CORVALLIS CONFERENCE OF IRRIGATION MANAGERS

"The fourth operation and maintenance . . conference in 1913 was held on November 6 and 7 at the Agricultural College at Corvallis, Oregon. The principal members of the College faculty met with the irrigation managers from projects in the State. The

subjects discussed were those having to do with the relations of the manager to the agricultural conditions and particularly to the character of crops raised by the new comers."

"In Oregon there has been an excess of enthusiasm on the subject of horticultural production, particularly of apples, because of the notable success of some of the enterprises, particularly those in Hood River. As a result thousands of Acres of orchards have been set out in all parts of the State and under all conditions of soil, climate, and drainage, both of air and water. No returns can be expected from some of these new orchards for a number of years, and the question arises as to how the men planting them can make a living up to the time that the orchards come into bearing. In some cases crops are raised between the rows of young trees by intercultivation and considerable returns realized from potatoes and other vegetables."

"There are certain dangers to the orchard connected with this intercultivation as the soil may be robbed in part of the fertility needed by the trees. On the other hand clean cultivation of the orchard in soil which is low in humus may result disastrously in burning out and impoverishing the soil. Cultivation of forage crops between the trees may be advantageous under some conditions. In short, there are so many

facts to be taken into account that the unskilled settler is liable to make several out of an almost infinite variety of blunders. To this is to be added the very serious consideration that horticultural experts do not believe that one out of ten of the trees planted will be commercially valuable."

"The importance of a thorough study of the peculiarities not only of each project but of the different kinds of soil on each project was brought out in the discussion. On the Umatilla project, for example, the soils vary from a fairly heavy loam to drifting sand dunes where the greatest care must be taken in putting in the crop to prevent its being blown out. In the latter case good judgment must be exercised not to clear the native vegetation in such a way as to permit the wind to sweep across bare spots, and precautions observed in putting in the crop so that it will begin to shade the ground before the winds can wear away the surface. Large quantities of water are required on these sandy soils. In general it must be applied in furrows and in considerable heads, in order to put the water over the ground quickly before it can completely saturate the subsoil. The more porous the sands the nearer together sould these furrows be placed. Experience and skill are required in irrigating these sandy lands, but as alfalfa, clover, and similar crops are turned in and nitrogenous matter

supplied, the amount of water needed is decreased."

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"The principal mistake made by the settlers is the attempt to raise at the outset the more delicate crops which require great skill, and in which the chance of success is far less than in ordinary farming. In other words, it will be better for these new irrigation projects if the settlers could be induced to try the safe, relatively sure crops and especially the raising of forage which can be fed to the cattle, sheep and hogs on the farm, bringing up the fertility, as some of these soils must be made valuable by long sustained work. The water holding capacity of many of these must also be increased at the same time that humus and nitrogen are supplied."

BERKELEY CONFERENCE OF IRRIGATION MANAGERS

The fifth conference of managers of irrigation works was held at the Agricultural College at Berkeley, Calif., on Nov. 12 and 13, 1912, between the men concerned with the handling of water to irrigators under private projects and those under works built by the Government, together with members of the College faculty. The principal topics discussed were those having to do with the details of delivery of water to the farms, expecially on a measured basis. It was the concensus of opinion that water, as in the case of any commodity,

must be delivered in such way that the amount paid will be in proportion to the amount delivered. In this way the necessary economy of water can be enforced and the destruction of the fertility of the land may be reduced. It was shown that the private companies which were operating throughout the West are looking largely to the Reclamation Service to set certain standards, not only in construction of works, but also in methods of operating and maintaining these after they are completed."

"Experience has shown that the successful handling of a large irrigation system requires a business manager whose experience and ability are comparable to those of the general manager of a railroad or of any large industrial institution. The success or failure of the works and the amount of crop returns over thousands of acres is dependent largely upon his skill and experience. Through lack of skill his operations may result in reducing the average crop value on, - say, 100,000 acres by $10 or $20, resulting in a loss to the community of $1,000,000 or $2,000,000, and yet to all outward appearances he may not have neglected any important duty."

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"The length of time required to put an irrigation system on a basis where the water users can repay the operation and maintenance charges has been a

matter of some surprise. The slowness with which the lands are actually used has, as a result, the effect that the operation and maintenance cost can rarely be met under 8 or 10 years. Meantime the interest charges on the investment rapidly accumulate and take away the profits of the enterprise.

It was also brought out that, as in the case of farming in general, so under the irrigated projects there is probably the greatest lack of general efficiency of any business. Few farmers know what their crops are actually costing them and dependence is placed upon tradition rather than upon observation. There is pressing need of actual data, based upon observation, as to the real cost of the various agricultural operations and crops."

"Under all of the irrigation projects in California as well as in other states, the land sales have taken place far more slowly than anticipated, resulting, as above stated, in difficulty in securing repayment of the operation cost, as some of the charges are practically fixed and must be met irrespective of the amount of land actually irrigated."

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Stress was laid on the necessity of economy in design in construction and of the development of talent in managerial capacity more than in engineering.

Special emphasis was placed on the need of force of character on the part of the manager, such as wins men to his views. The greatest difficulty which has been experienced in finding competent managers was lack of this character and of "backbone" in adhering to principles which lead to the greatest good to the greatest number.

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"In the case of the private companies and irrigation districts it was noted that very few accurate records of water deliveries and of costs are being kept, the directors of these companies not appreciating the importance of measuring the amount of water which is delivered to the various laterals and turned to the land; hence it is impossible to know how much water is actually being put upon many of the areas and the cost of details of the work."

"In the matter of leveling the land for irrigation the first estimates made in California were generally about $15. or $20. per acre, but experience has shown that expenditures as high as from $35. to $60. per acre are justified in getting the surface as nearly level as possible and in providing checks to facilitate rapid irrigation, so that irrigation can be carried on at the rate of 3 acres per hour, a head of 10 to 15 second-feet being used.

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"There is probably the greatest amount of inefficiency in farming of any other business and the efforts of the canal manager must be continually directed toward bringing about the welfare of the man who tills the soil."

"The most efficient manager of an irrigation system is usually one who has had experience in large corporations and who has had training in handling large affairs."

APPENDIX II

EXCERPTS FROM STATEMENT BY PROFESSOR F. H. NEWELL, THEN DIRECTOR OF THE UNITED STATES RECLAMATION SERVICE, ON CAPITAL REQUIRED BY AN IRRIGATION FARMER AND SIZE OF FARM UNITS.

(Italics not in original)

"In compiling the information given in the manuscript, farm units of 20 acres, 40 acres and 60 acres have been considered as being the most feasible and practicable sizes cultivatible by the efforts of one man.*******It will be appreciated that the figues on farm returns will in some cases be rather large and in other cases rather small. The fact that they are average and conservative values should be borne in mind in making suggestions. The aim has been to be entirely on the side of conservatism."

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"CAPITAL REQUIRED BY AN IRRIGATION FARMER

1. It is the object of this publication to answer inquiries frequently made as to the amount of capital required to undertake irrigation farming on the projects of the Reclamation Service. In presenting this information no claim is made as to absolute accuracy, because the amount of capital required

by one man for undertaking irrigation farming would be entirely different from that required by another man of more experience and practical and economical qualities. It is believed, however, that the information given will be of sufficient accuracy to be of help in making estimates by those who are interested in taking up this occupation. *******"

"2. It must first be realized that farming is an occupation that requires energy, judgment, business ability and experience, as well as money, to produce satisfactory results from the outset. There is too often prevalent an idea that the man who can not succeed in any other line of work can at least succeed in the line of farming. Within the last ten years agriculture has rapidly grown to be a science, and it takes an abundance of careful, patient thought and industry to accomplish good results."

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"8. In view of the three foregoing types of farms, (intensive, semi-intensive or diversified, and grain and stock) that may be made practicable in all regions of the arid west, there have been tabulated for the information of the homeseeker, the rough costs of improvements, equipment, stock, feed, seed and trees for each of the foregoing sizes of farms. The expenditures for improvements, equipment and stock are those required during the first three years operations

of the farms and need not necessarily be all made the first year although the greater portion should be so made. The expenditures for feed and seed and trees are for the first year only. In table No. 41 will be found information relating to a 20-acre farm. * * * These figures should, of course, be considered as approximations susceptiable of considerable elasticity to suit the individuality of the settler. They are based on the purchase of new equipment, and the construction of new buildings on which the farmer will do a large part of the work himself assisted by a carpenter, and on the purchase of ample stock to start the farm well."

"9. In tables Nos. 42 and 43 will be found similar information for 40-acre and 60-acre farms."

"10. In Table No. 44 is given, in connection with each project of the Reclamation Service on which water is being furnished, information on the approximate cost of land, water-rights and annual operation and maintenance service.******"

"11. In those regions where the earnings of the farm can be applied to the purchase of land, it is the custom to buy the land partly on credit. <u>This practice is not advisable in an irrigated country where indebtedness exists for water-rights, as the earnings of the farms must be applied to the payment of this obligation.</u>

(This is almost never over $50. per acre). It is best, therefore, to purchase the land out-right, if public land is not available on which filing can be made."

"12. No estimate has been given on the cost of household goods or on the cost of living, inasmuch as these expenses vary so much with the tastes, desires and frugality of the family. In estimating the amount of money required for living expenses while the farm is getting into condition to produce, capital enough should be provided to furnish practically all the requirements of the family for one year."

"13. After having selected the size of farm that the prospective homeseeker desired, he can obtain an estimate from either table Nos. 41, 42 or 43, according to the size of the farm chosen, of the cost of buildings, equipment, stock, feed, seed and trees required for his farm. To this he should add the estimated purchase price of the land as set forth on Table 44. He should then add to this sum the estimated cost of his household goods, his living expenses for one year and the necessary transportation expenses from his present home to the farm, which will give him an approximate idea of the amount of capital required to properly finance his undertaking."

"14. In Table No. 45, have been tabulated, under the headings there given, an estimate of the income

for 20-acre, 40-acre, and 60-acre farms for the first, second and third years' operation for the estimated equipment and stock conditions given in tables Nos. 41, 42 and 43. The incomes given in Table No. 45 have been classified under the headings "Small", "Fair", and "Good", comparable with the same headings given in tables Nos. 41, 42 and 43, so as to make these incomes representative of a large range of territory, and so as to provide for the element of chance entering into the production of crops and animals. The figures are given for the purpose of assisting the homeseeker in making a rapid and approximate estimate of the incomes from farms of various sizes on Reclamation projects. No high degree of accuracy is claimed for these figures, and this must be borne in mind by the persons using the table. An attempt has been made to make the figures as a whole entirely conservative for the average man. There are men who succeed in the face of the apparently impossible, and others who fail in spite of every reasonable opportunity for success. For neither of these classes can limiting figures be prescribed."

"15. The returns given from the sales of crops are values computed from production in the excess of requirements for the use of the family, and the feeding of the stock on the farm. It is evident that these returns will depend very largely on the character of

crops cultivated by the farmer. * * * * * The figures given are intended to be representative of normal results obtained by average farmers under the adverse conditions of opening up new lands."

"16. The returns for poultry and dairy products are estimates of the returns from sales after a small family has been supplied with its own needs. The values given can be realized only with intelligent care and industry in handling good poultry and cows."

"17. Under the heading of "Stock Sales" are given the estimated sales of stock produced from the original purchase of stock placed on the farm, as given in tables Nos. 41, 42 and 43. These values are based on the farmer starting out with good breeding stock, and using due diligence and care in handling them."

"18. Under the heading of "Increased Stock Values" are given the values of increase of young stock produced from the original stock from year to year, and from the increased value of some of the original purchase. In compiling these figures it has been assumed that nothing but a good grade of stock will have been originally acquired. Where cheap values of stock are shown, these figures are assumed to represent the purchase of stock that has not yet reached full maturity, so that there will be an increased value of such animals from year to year until they have reached their maturity."

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"20. The data have not been extended beyond the third year, as it has been assumed that after the first three years the returns from the farms will be capable of substantial increase under good management and industry in getting the land into good condition and under cultivation."

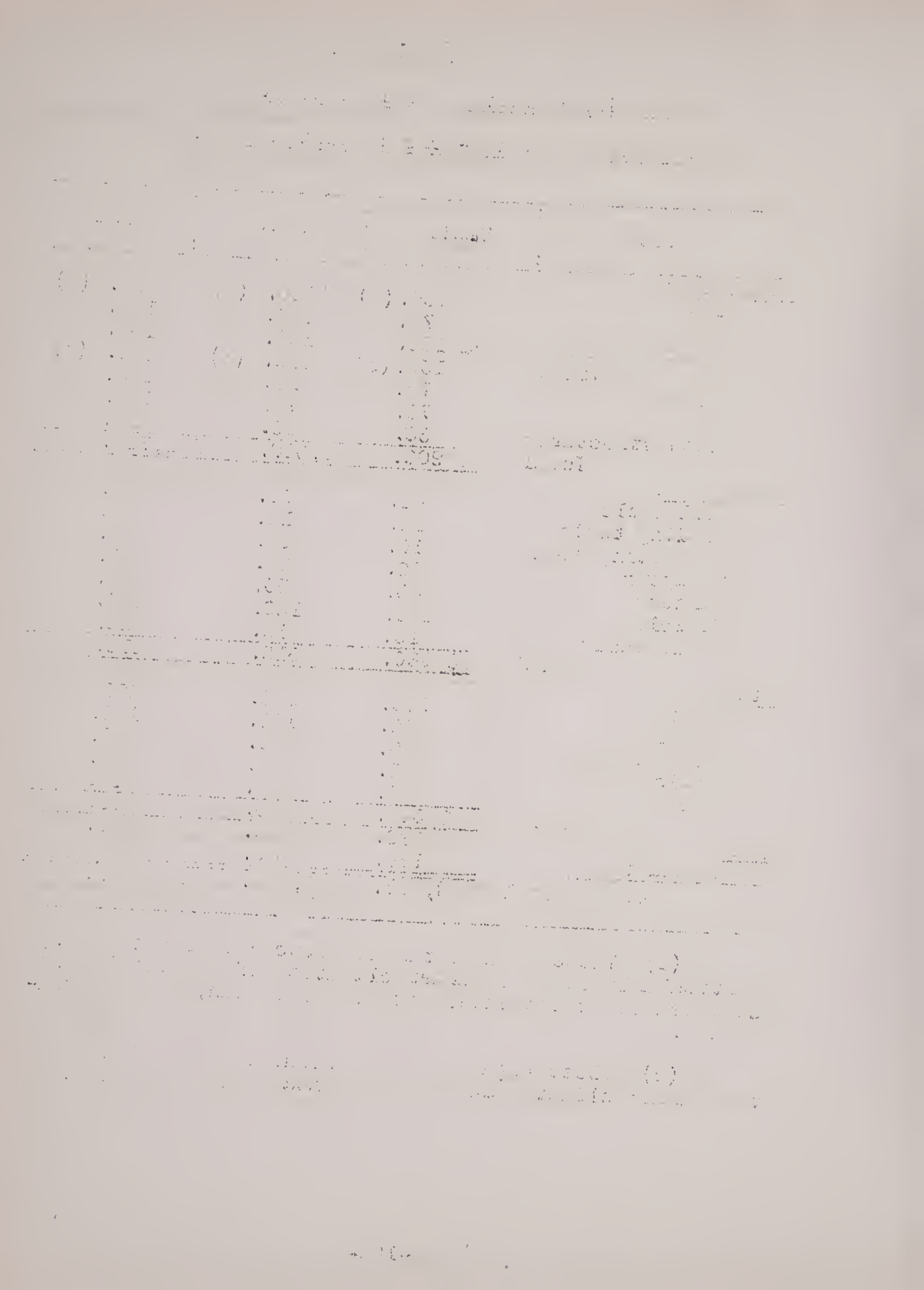
(Table No. 41)

Cost of improvements, Equipment, Stock, Feed, Seed and Trees for a Twenty-acre Irrigated Farm.

Item	Small	Fair	Good
Buildings:			
House	$400. (a)	$600. (a)	$800. (a)
Barn	75.	100.	150.
Granary or fruit shed	100.	100.	100.
Other buildings	150. (b)	250. (b)	300. (b)
Fences	75.	125.	175.
Well	70.	75.	125.
Ditch structures	30.	50.	50.
Total	$ 900.	$ 1,300.	$ 1,700.
Equipment:			
Soil tools	60.	75.	75.
Seeding tools	10.	10.	15.
Harvesting tools	10.	10.	25.
Sprayers	20.	20.	20.
Harness	40.	50.	50.
Vehicles	130.	130.	200.
Small tools	10.	15.	25.
Total	$ 280.	$ 310.	$ 410.
Stock:			
Horses	200.	250.	300.
Cattle	80.	120.	150.
Hogs or sheep	40.	180.	80.
Fowls	25.	25.	25.
Bees	0.	10.	10.
Total	$ 345.	$ 585.	$ 585.
Feed	380.	390.	460.
Seeds and trees	180.	180.	180.
Grand Total	$ 2,085.	$ 2,745.	$ 3,315.

(a) These figures may be reduced by about $200., particularly for the warmer climates, if the settler is disposed to be contented with the accompanying inconveniences.

(b) These figures may be reduced about $100. for the warmer climates and for very meager conveniences.



(Table No. 42)

Cost of Improvements, Equipment, Stock, Feed, Seed and Trees for a Forty-acre Irrigated Farm.

Item	Small	Fair	Good
Buildings:			
House	$ 400. (a)	$ 600. (a)	$ 800. (a)
Barn	100.	150.	200.
Granary or fruit shed	1125.	125.	125.
Other buildings	250. (b)	300. (b)	350. (b)
Fences	100.	175.	250.
Well	75.	75.	100.
Ditch structures	50.	75.	75.
Total	$ 1,100.	$ 1,500.	$ 1,900.
Equipment:			
Soil tools	70.	75.	100.
Seeding tools	15.	80.	140.
Harvesting tools	20.	110.	255.
Sprayers	20.	35.	45.
Harness	45.	50.	90.
Vehicles	150.	240.	340.
Small tools	15.	20.	23.
Total	$ 335.	$ 610.	$ 1,083.
Stock:			
Horses	300.	300.	375.
Cattle	150.	225.	275.
Hogs or sheep	80.	80.	100.
Fowls	25.	25.	25.
Bees	15.	20.	20.
Total	$ 570.	$ 650.	$ 795.
Feed:	390.	455.	520.
Seed and trees	150.	150.	150.
Grand Total	$ 2,545.	$ 3,365.	$ 4,450.

(a) These figures may be reduced by about $200., particularly for the warmer climates, if the settler is disposed to to be contented with the accompanying inconveniences.

(b) These figures may be reduced by about $150. for the warmer climates and for very meager conveniences.

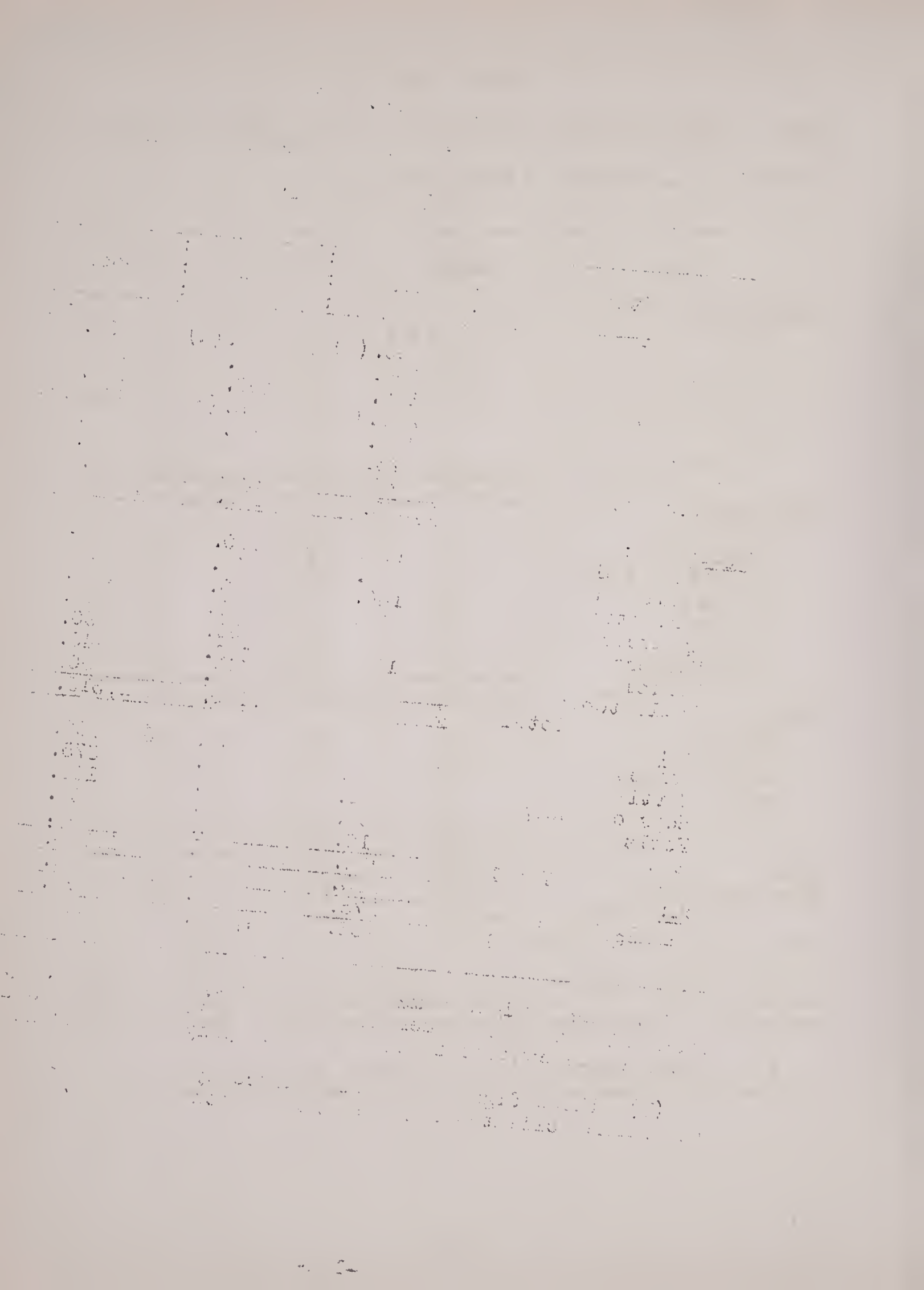
(Table No. 43)

Cost of Improvements, Equipment, Stock, Feed, Seed and Trees for a Sixty-acre Irrigated Farm.

Item	Small	Fair	Good
Buildings:			
House	$ 400. (a)	$ 600. (a)	$ 800. (a)
Barn	150.	200.	250
Granary	150.	150.	150.
Other buildings	280. (b)	335. (b)	400. (b)
Fences	120.	200.	280.
Well	75.	75.	100.
Ditch structures	75.	100.	100.
Total	$ 1,250.	$ 1,660.	$ 2,080.
Equipment:			
Soil tools	$ 110.	$ 170.	$ 210.
Seeding tools	15.	140.	160.
Harvesting tools	140.	300.	320.
Sprayers	35.	45.	45.
Harness	90.	90.	90.
Vehicles	190.	340.	440.
Small tools	25.	35.	50.
Total	$ 605.	$ 1,120.	$ 1,315.
Stock:			
Horses	$ 450.	$ 500.	$ 600.
Cattle	230.	325.	375.
Hogs or sheep	80.	80.	100.
Fowls	25.	25.	25.
Bees	10.	20.	20.
Total	$ 795.	$ 950.	$ 1,120.
Feed:	380.	390.	800.
Seed and trees	175.	175.	175.
Grand Total	$ 3,405.	$ 4,495.	$ 5,490.

(a) These figures may be reduced by about $300., particularly for the warmer climates, if the settler is disposed to be contented with the accompanying inconveniences.

(b) These figures may be reduced by about $150. for the warmer climates and very meager conveniences.



(Table No. 44.)

Cost per acre of Land, Water-rights, Operation and Maintenance Expenses, Irrigation Projects U.S.R.S. for 1912

	Private Land	Relinquishment and Filing Fee Public Land	Water Right: Total of 10 Payments	Water Right: Payments for First and second Years: 1st	Water Right: Payments for First and second Years: 2nd	Approximate O.& M. Charge
Ariz., Salt River	$ 100	Little	$50(a)	$5.00(a)	$5.00(a)	$1.50(a)
Ariz.-Cal., Yuma	50-100		66	5.50	1.00	2.00
Cal., Orland	100-120	None	45(a)	4.50	4.50(a)	1.00(a)
Colo., Uncompahgre Valley	50-150		70(a)	7.00	7.00(a)	1.00(a)
Idaho, Boise	50-100		66(a)	6.60	6.60(a)	1.00(a)
" , Minidoka	100	$10-50	40	1.00	1.50	1.75
Mont., Huntley	20-50		30	3.00	3.00(b)	1.00
" , Milk River	75-100		39(a)	3.90	3.90(a)	1.00(a)
" , Sun River	75-100		36	3.00	1.00	1.00
Mont.-N.Dak., Lr. Yellowstone			45	2.00	4.50	1.50
Neb.-Wyo., North Platte	75-100		55	1.00	2.00	1.40
Nev.-Truckee-Carson	75		30	3.00	3.00	0.75
N. Mex., Carlsbad	50-100	None	45	5.60	3.00	1.75
N. Mex.-Tex., Rio Grande	200-300	Little	56(a)	5.60	5.60(a)	1.00(a)
N. Dak., N. D. Pump	100	Little	38	3.80	3.80	1.50(c
Ore.-Umatilla	60-100	$15.00	(60	6.00	6.00	
			(70	2.00	3.00	1.30
Ore.-Cal., Klamath	40		30	3.00	3.00	0.75
S. Dak., Belle Fourche	30-50		40	4.00	4.00	0.60
Wash., Okanogan	200-300	Little	65(d)	8.00	8.00	2.25
Wash., Yak., Sunnyside	100-200	Little	52	5.20	5.20	0.95
Wash., Yak., Tieton	125-175	$25-100	93	9.30	9.30	1.50
Wyo., Shoshone	25-75	25-50	52	4.70	4.70	1.00

Projects formally opened several of which have graduated payments.

(a) Estimated, project not formally opened.

(b) $4.00 per acre to be paid to Indians - $1.00 1st year $.75 for 4 succeeding years.

(c) $1.00 per acre-foot of water used additional.

(d) New contract not exceeding $110. per acre.

(Table No. 45.)

Estimated Farm Returns and Increased Stock Values for First Three Years Operation for Twenty, Forty and Sixty-acre Farms for Arid States.

	First Year			Second Year			Third Year		
	Small	Fair	Good	Small	Fair	Good	Small	Fair	Good
20-Acre Farm									
Crop Sales	60	80	100	100	150	200	125	150	200
Poultry products		25	35	50	75	100	75	100	120
Dairy products		30	40	20	40	40	40	40	40
Stock sales	30	125	225	110	265	320	110	270	320
Increased stock values	60	40		40			30		
Totals	150	300	400	320	530	660	380	560	680
40-Acre Farm									
Crop sales	100	150	200	200	250	300	250	300	400
Poultry products		25	35	50	75	100	50	75	100
Dairy products	40	65	80	40	70	100	60	100	140
Stock sales	60	110	150	130	195	260	250	305	340
Increased stock values	70	80	65	140	140	140	120	120	120
Totals	270	430	530	560	730	900	730	900	1100
60-Acre Farm									
Crop sales	100	150	200	200	250	300	250	300	350
Poultry products		25	35	50	75	100	50	75	100
Dairy products	60	100	140	60	100	140	60	100	140
Stock sales	60	150	185	200	165	200	320	425	440
Increased stock values	100	135	80	130	250	160	120	200	150
Totals	320	560	640	640	840	900	800	1100	1180

Compare figuring tables with data in Chapter VIII.

"1. Section 4 of the Reclamation Act makes it the duty of the Secretary of the Interior to fix the "limit of area per entry, which limit shall represent the acreage which, in the opinion of the Secretary may be reasonably required for the support of a family upon the land in question."

****

"4. * * * * An examination of other evidence than that of interested parties (land owners) is therefore essential in order to arrive at the facts which should govern the Secretary in his decision on this point."

"5. There must be taken into account a wide range of conditions not only as to the character of the soil and its surface condition, but also as to climate, nearness to markets, customs of the country, and particularly the degree of ability or experience of the people who will probably attempt to cultivate these lands. It may be stated that, as a general rule, any lands of the arid region which are not exceedingly rough or rocky are capable of producing crops under irrigation because of the fact that with the large amount of sunshine such as is characteristic of the arid region, the soil can be brought to a high degree of productiveness with reasonable labor and intelligence."

****

"7. The question of markets is to a certain extent

less important, as railroad transportation as a rule is provided soon after the projects are well under way. In all irrigation enterprises, whether undertaken by public or private capital, the question as to the lands themselves have been found to be relatively simple, not involving unusual difficulties, as there have been few insurmountable obstacles yet encountered either in the way of subduing the soil or in the extremes of climate in the arid portions of the United States. It is, therefore, not necessary to devote to the subject of the lands more study than is required by usual practice."

****

"10. The Census figures show that the average gross income from farms of 160 acres or less have been under $1000. or less than $50 per acre. This amount does not include the food consumed by the family, nor the item of rent which is covered by the ownership of the land. There are, of course, many farmers who are receiving a larger income and others far less, but taking the average of all farmers of the United States, we cannot go far astray on considerations of the amount required for the support of a family."

****

"14. The character of crop and of cultivation is fixed largely by the area of the farm, and the financial means of the owner. If, for example, the farmer has a

limited area of say 40 acres, as is the case on the Huntley project in Montana, he must produce a relatively valuable crop and for success must concentrate his energies on some special item as, for example, sugar beets. In other projects, he must raise perhaps alfalfa, and feed this to dairy cows or practice some other form of intensive agriculture."

"15. The newcomer to an irrigated area rarely has adequate capital to improve a large farm and get it into productive capacity. The small amount of money which he does have is usually expended in making first payment, or securing possession of an area so large that he cannot make a second payment nor put the ground in proper condition for crop production. He scatters his efforts over the entire area of say 80 acres, whereas, if he had limited himself to 40 acres he would have had enough money to really prepare and level, perhaps, five acres, and put it in alfalfa."

"16. As a result, at the end of the first year, he has produced a cheap, quick-selling crop, such as grain, and the land has not been leveled nor improved. On the contrary, the improverishment of the soil has already begun or continued. The same thing is true at the end of the second year. His necessities have forced him to still continue grain farming, and while his neighbor with half the area has used some of his time and money to put in good shape each year at least five

acres of land, the first man is losing his time and money and the soil is deteriorating. In other words, the large irrigated farm forces the ordinary settler into poor and uneconomical methods of farming."

"17. The determination of the size of the farm unit is at the basis of the economic development of a project. So far as is now known no farm units on any public or private projects have yet been set too small. On the other hand, the tendency has been almost invariably to make them too large, so large in fact that, with the small capital available, the farmer is forced to neglect intensive cultivation, even of the home garden, and as above stated to attempt the broad cultivation of grains with correspondingly diminished chances of securing a livelihood for his family, and with a steady loss of soil fertility. Years must elapse before all of the surface can be leveled and brought to a high degree of cultivation and in the meantime the owner is unable to keep up his payments for building, operating and maintaining the system. This is the largest single cause of failure of private projects."

****

"19. In short, the principal factor in the agricultural success of any area irrigated either by private or public capital is dependent upon the size of the farms as originally obtained by individuals. The somewhat arbitrary determination in advance of the size of

these farms has brought about an adjustment of crops and of methods of cultivation to such a degree that the questions of climate, soil, and other physical conditions have become relatively subordinate."

"23. In the following table statistics from the last Census are given, showing, for specified counties, the average improved acreage per farm for farms under 175 acres in size, the per cent of the total number of farms irrigated, and the per cent of the total number of farms represented by farms under 50 acres in size. Improved acreage has been used rather than irrigated acreage, as the latter includes wild grass land, while improved acreage does not. As defined by the Census Bureau, improved land includes all land regularly tilled or mowed, land pastured and cropped in rotation, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings."

(Table No. 46)

States and counties	Average improved acreage per farm under 175 acres	Per cent of total farms irrigated	Per cent of total farms under 50 acres
California:			
Fresno	38.0	85.0	65.8
Imperial	69.2	94.6	25.3
Inyo	43.7	93.3	25.8
Los Angeles	22.5	59.0	76.9
Merced	43.6	78.3	53.5
Orange	39.1	70.0	75.9
Riverside	27.6	80.9	63.8
San Bernardino	23.9	83.5	76.7
San Diego	32.3	38.7	44.1

****

"25. On the Government projects the farms are passing through a period of evolution and adjustment. Only a small percentage are farming in accordance with the practices which experience has shown must be followed to achieve the greatest returns. It would be a mistake in this period to increase the size of the farm, as it would tend further to scatter the energies of the farmer and encourage him to continue in the present practice, which is not the correct one. The irrigation farmer must practice intensive farming. Owing to labor conditions he cannot do this on a large farm."

"26. In fixing a farm area in excess of 40 acres special consideration should be given to the question of farm labor. A 40-acre unit intelligently cultivated can be cared for by the owner and his family. An 80-acre farm will require the services of at least one hired man."

"27. Today there is no more difficult problem in the west than that of securing efficient farm help. In fact it may be said that this kind of help is not to be found. Crops are sown in many parts of the west and farmers cannot get help to harvest them."

"28. An analysis of results shows that the yield per acre from the 40-acre farms averages 25% greater than from those of 80 acres. The whole problem of Reclamation is involved in obtaining the maximum yield per acre, and this is always promoted by the small farm unit."

"39. The evident intent of the Reclamation Act is to make the maximum number of prosperous homes for American citizens. The average man who seeks these farms, as shown by the records, has less than $1,000. Only a small percentage has more than $2,000."

****

"37. **** The large farm unit retards the development and cultivation of the land. Settlers on the northern and central projects average only about 12 to 15 acres of reclaimed land per year, so that it is not until the third year that the majority have 40 acres in cultivation. It is not until the fourth or fifth year that the majority get even forty acres of their lands to the degree of cultivation which is to be followed to make a success of the new farm."

****

"41. In this connection it is interesting to note that careful records kept by the experiment stations show even higher values for alfalfa fed to dairy stock. On a number of small herds in Idaho the experiments showed that the herds paid in excess of $18. per ton for the alfalfa consumed. One herd at Caldwell paid its owner more than $23. per ton."

(Compare with item "Dairying" Chapter VIII)

"42. In the arid southwest, with the semi-tropic climate, thousands of families are making a good living

from tracts ranging from 5 to 20 acres, cultivated in fruit or vegetables. This practical demonstration, which can be examined on the ground by any one, is the best proof of the allegation that a family can be supported on such an acreage. To the commonly repeated claim that this cannot be done except by bringing the land to a high state of culture it may be answered that this is true and is the best reason why the settler should not be allowed a larger acreage than his means will permit him to bring to a high state of culture."

****

"46. A recent report from the Yuma Project is as follows:

Analysis has been made of the crop returns on this project for the year 1911 and the following are submitted:

(Table No. 47.)

Results on 30-acre tract of Alfalfa Hay.

Cost per acre;		Yield per acre
Keeping ditches clean of Bermuda, etc.,	$5.00	
Water -- 5.a.f. at 30¢	2.50	7 cuttings or 7 tons
Cutting and stacking	16.00	at $10 on ranch-$70.
Baling	13.50	
Total	$ 37.00	

$70. less $37. equals $33. net gain per acre.

(Table No. 48.)

Alfalfa Hay and Seed

Cost per acre:		Yield per acre:	
Ditch cleaning	$3.00	4 1/2 tons of hay @ $10.	$45.00
Water	2.50	1 ton straw	3.00
Cutting, threshing and stacking	21.00	215 lbs. alfalfa seed	21.50
Baling	9.00		
	$37.50		$71.50

$71.50 less $37.50 equals $34. net returns per acre."

(Compare with item "Alfalfa" Chapter VIII)

"47. This table covers the combination of alfalfa and alfalfa seed, the net returns per acre being $34. on the average. It is true that in some cases far better yields were received, the maximum being 900 pounds per acre, but we have used averages as the only safe guide in determining the farm unit for the ordinary settler."

" "There is one dairy farm in the Yuma Valley upon which some general costs have been obtained, but we could not get the data in any great detail. The returns from this farm are shown in Table 49."

(Table No. 49.)

Results on 40 acre tract.

Cost per acre:		Yield per acre:	
Labor, including care of cows, haying, etc., on 40-acre ranch, (total $1500), per acre . . .	$37.50	Gross...	$135.00

$135.00 less $37.50 equals $97.50 net returns per acre.

(Table No. 49 cont'd.)

Total net returns from 40 acres . . . . . .$3,900.

(Compare with item "Dairying" Chapter VIII.)

"48. On such a farm the investment for cows, barns, and other improvements is of course heavy, but the returns per acre are not unusual nor excessive and if duplicated upon a 15-acre ranch, requiring only about one-third the investment, would return about $1,460. per year above the cost of labor."

****

"59. Following is the statement of an entryman on a 40-acre homestead near Powell, Wyoming.:

'I arrived here in December, 1918, with about $800. which I put in my buildings, fences, etc.

The following spring I sowed oats and wheat. The land was full plowed in 1909, disced and leveled in the spring of 1910 and I sowed 30 acres of alfalfa in on the stubble; 3 acres of wheat, 1/2 acre in garden and 15 acres in oats.

The first year I secured 58 bushels of oats to the acre and 30 bushels of wheat to the acre. The crop was valued at $1500. at the price then prevailing. Besides my grain crop I sold a great deal of straw and fed through the winter and still have a good stack left.

A man going on a place should invest his money about as follows: Buildings, $300; fences, $100; implements, $200; three horses and cow, $400; seed, $50; living at $30. a month, $360.'"

"60. For the Umatilla Project, Oregon, it is stated that 20 acres is:

'small for one who is a good farmer and who has sufficient means; 40 acres would seem better yet. However, on account of the expense of preparing new land, meeting water payments, etc., an area of 40 acres involves too great an expenditure of money for the majority of settlers. On this project units

of about 20 irrigable acres seem to have been in greatest demand. I believe in years to come as a project settles up the tendency will be for the farms to become smaller. In the early stages of a project, however, intensive cultivation is out of the question. The problem is to subdue the soil, raise what you can, and establish a community, intensive cultivation must follow this preliminary work. Therefore I believe units should be made sufficiently large for general farming and some stock raising. Our experience thus far indicates that the irrigable area of farm units should range from a minimum of about 20 irrigable acres to a maximum of 40 irrigable acres.'"

****

"66. The concensus of opinion of Project Managers as to the desirable acreage for farm units on Reclamation Service projects is as follows:

(Table No.30.)

Project	Economical Acreage From	To
Umatilla, Ore.	20	40
Truckee-Carson, Nev.	40	80
Milk River, Mont.	40	80
Klamath, Ore.	40	60
Orland, Cal.	10	40
Okanogan, Wash.	--	20
Shoshone, Wyo.	40	80
Strawberry Valley, Utah	40	40
Sunnyside, Wash.	10	40
Huntley, Mont.	40	--

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